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ABSTRACT

Participants in the 1998 annual technology conference of the Council of Educational Facility Planners, International discussed adapting today's school buildings to meet the new educational technology. This document presents the presentation materials (mostly copies of slides or transparencies, with little or no accompanying text) delivered by speakers at the conference. Each presenter addressed the overall subject of the classroom of the future and explored such topics as educational technology planning, developing computer and video infrastructures, educational technology costs, hardware considerations, and bidding and purchasing of technology. (GR)

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Preparing Your School Building for Technology.
Proceedings of the
Council of Educational Facility Planners International (CEFPI) Conference
(Vancouver, British Columbia, Canada, October 4-7, 1998)

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CEFPI's 1998 Technology Conference
Preparing Your School Building for Technology

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**CEFPI THANKS
THE TECHWEST 1998 EXHIBITORS
FOR THEIR GENEROSITY IN
DISPLAYING THE**

CLASSROOM OF THE FUTURE

INTERIOR CONCEPTS

**NETWORK INFRASTRUCTURE
CORPORATION (NIC)**

RAULAND-BORG CORPORATION

ZENITH ELECTRONICS

TECHWEST 1998 EXHIBITORS

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Ben Casados

Preparing Your School Buildings for Technology

The Council of Educational Facility Planners, International is fortunate to have wonderful resources within its membership—people whose knowledge, understanding, and experience in educational facility development is unmatched worldwide. It is with great pride and gratitude that we thank the following outstanding CEFPI members and other professionals who have shared their expertise as presenters at our annual Technology Conference.

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MAXIMIZING YOUR PURCHASING DOLLARS.

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HOW DO YOU DETERMINE THE TECHNOLOGY WHICH WORKS FOR YOUR INSTRUCTIONAL SPACE?

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PRIMARY FACTOR WHICH DETERMINES TECHNOLOGY

Oversimplification:

THE “CURRICULUM”

**What Do You Want The Learner To
Learn In Your Instructional Space?**

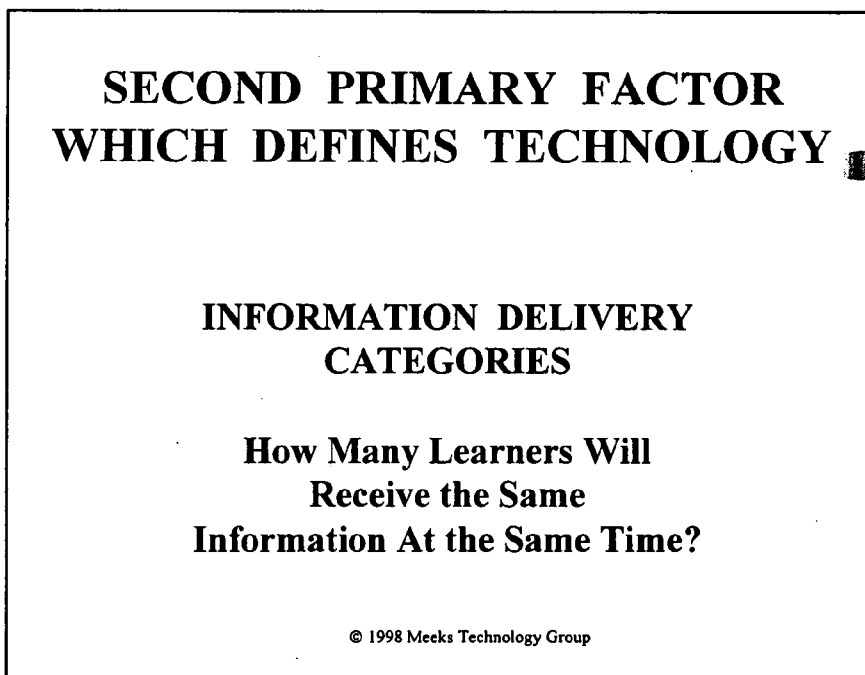
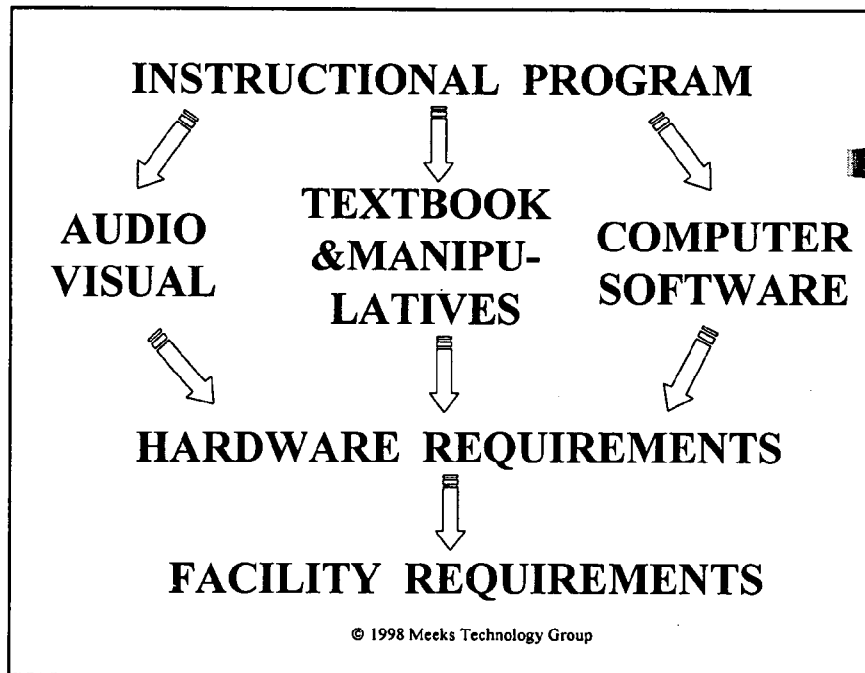
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THE CURRICULUM DRIVES THE INSTRUCTIONAL PROGRAM

- **CURRICULUM - What Is The Learner Supposed To Learn?**
- **INSTRUCTIONAL PROGRAM - What Activities Enable The Learner To Gain The Knowledge Or Skill They Are Supposed To Gain?**

(Classroom Activities/Tasks)

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INFORMATION DELIVERY CATEGORIES

- **Workstations**
One To Three People
- **Work Groups**
Six To Eight People Utilizing Workstations
Simultaneously / Interactively For A Project
- **Presentation Systems**
Information Presentation To Ten Or More People

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SPECIFIC TECHNOLOGIES LEND THEMSELVES TO SPECIFIC TASKS

Classroom Tasks



Video



No



Computer

Technology

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THIRD PRIMARY FACTOR WHICH DEFINES TECHNOLOGY

**Do You Intend To Move The Learner To
The Site of The Knowledge Base?**

VERSUS

**Do You Desire To Move The Knowledge
Base To The Site Of The Learner?**

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FACTORS WHICH INFLUENCE TECHNOLOGY FROM USERS VIEWPOINT

- **Must Be Easy To Use**
- **Must Be Readily Available**
- **Must Improve Existing Method Of Doing Things**
- **There Must Be A Large Users Group Ready To Adopt The Use Of Technology**

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**THIS VIEWPOINT IMPLIES
THERE SHOULD BE A
PLAN.
(Maximizing Purchasing Dollars)**

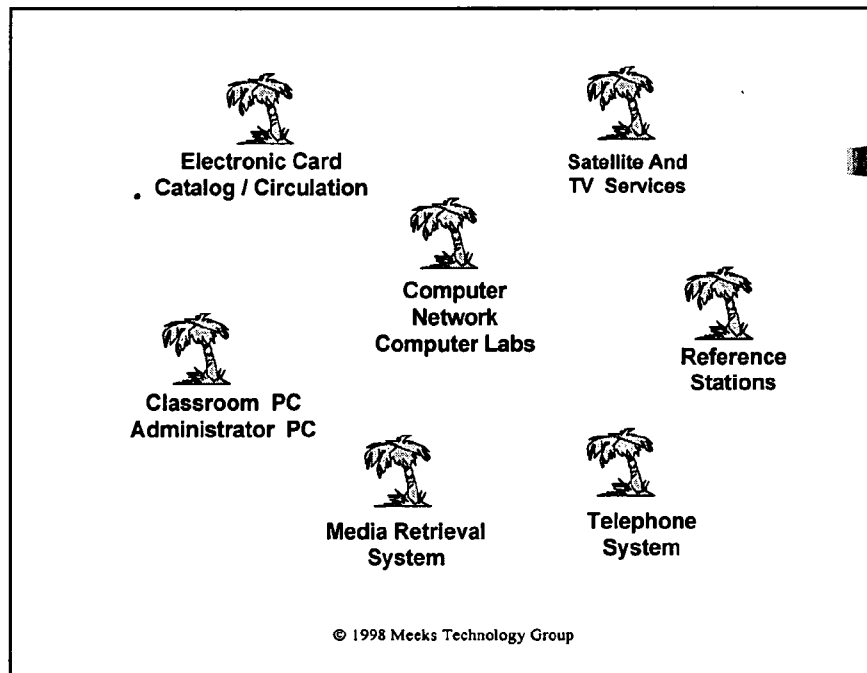
**WHAT HAPPENS WHEN
A "PLAN" IS NOT
IMPLEMENTED?**

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ISLANDS OF TECHNOLOGY

**Various Technologies Are Purchased
Independently Of Each Other,
Which Are Not Capable Of
Communicating With Each Other
(Bridges Between The Islands)**

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Technology Planning Involves More Than Planning For Hardware and Systems

**Curriculum/Instructional Program,
Staff Development Plans,
Technology Plans**

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**The curriculum, staff
development, and technology
plan are interdependent with
each other.**

**If you do not find common threads running
through the different plans, there are
holes in the process.**

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CURRICULUM / INSTRUCTIONAL PROGRAM

**Sets Goal and Vision Which Drives Technology
Implementation**

- **Demonstrable Learner Skill Outcome**
- **Curricula Tasks Matched to Appropriate
Technology & Applications**
- **Definition of Person Responsible for Integrating
Technology into Curriculum**
- **Define Assessment and Evaluation Process**

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STAFF DEVELOPMENT PLAN

**Training the Instructor For Use of Technology in the
Instructional Space**

- **Philosophy Of How Technology Changes
Business In The Classroom.**
- **Training on How to Use Technology In The
Instructional Space.**
- **Training on How to Generate Content For Use In
Instructional Space.**
- **Training for Lesson Plans Revolving Around
Technology.**
- **Start Process of Finding Appropriate Content
(Shows, Workshops, Seminars.)**

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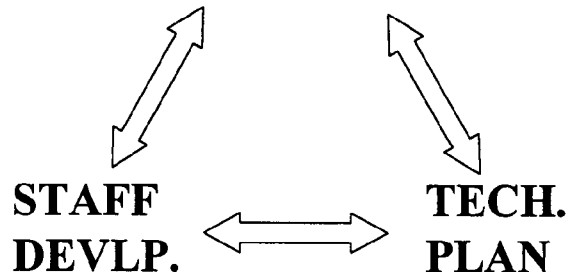
TECHNOLOGY PLAN

Implementation of Technology in the Instructional Space

- **Data Networks**
- **Voice Networks**
- **Video Networks**
- **Wide Area Networks**
- **Library and Administrative Systems**
- **Timeline and Cost Estimates**

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CURRICULUM / INSTRUCTIONAL PROGRAM



PLANS RESONATE WITH EACH OTHER

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HOW THE PLANS INTERTWINE

- What Instructional Task Are You Accomplishing with Technology? (Cur.)
- What Courseware Meets Content Requirements? (Cur.)
- What Hardware Needs to Be in Place? (Tech.)
- What Facility Upgrades are Required? (Tech.)
- How Will the Teacher be Trained To Use The New Courseware and Hardware? (Staff Development)

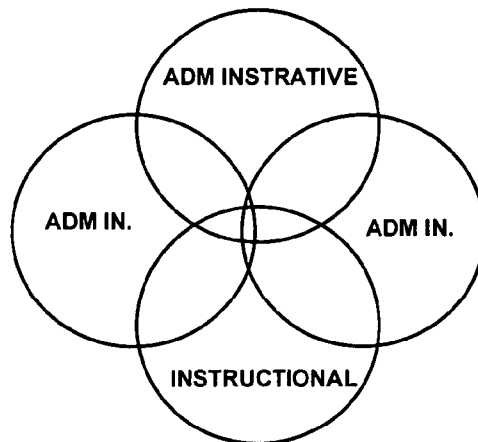
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TECHNOLOGY IN EDUCATION

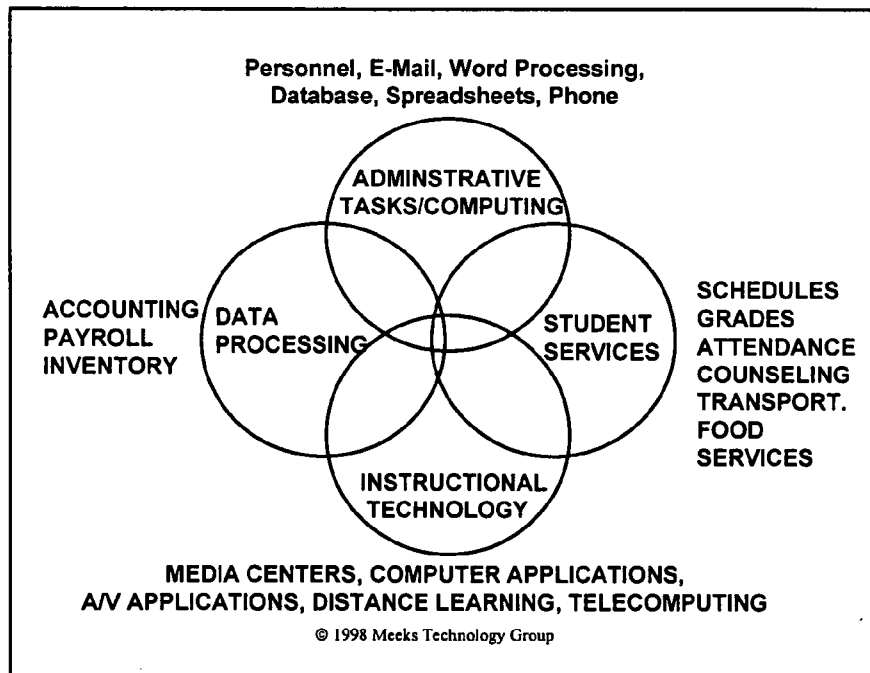
An Overview

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AREAS WHERE TECHNOLOGY IS USED IN EDUCATION



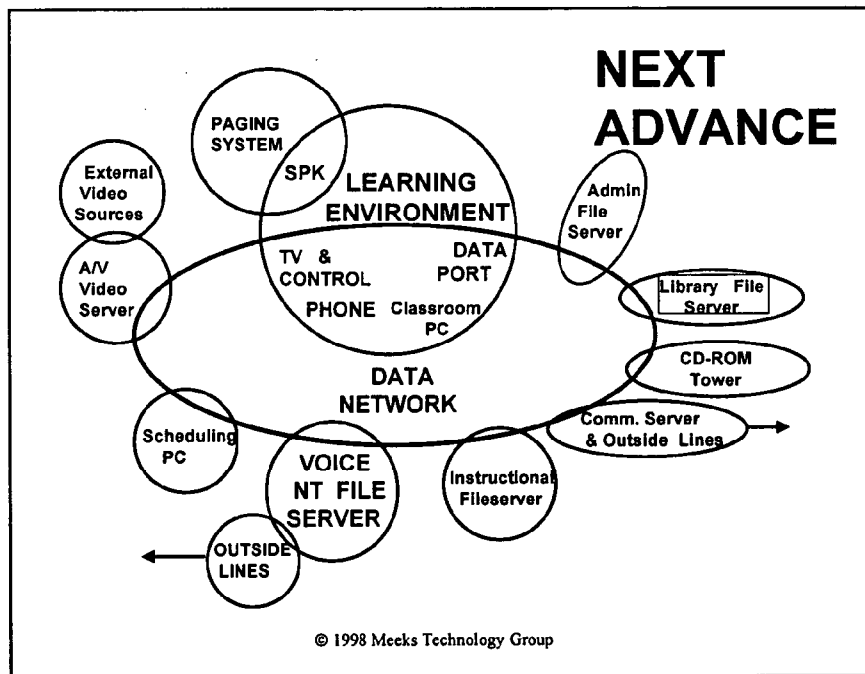
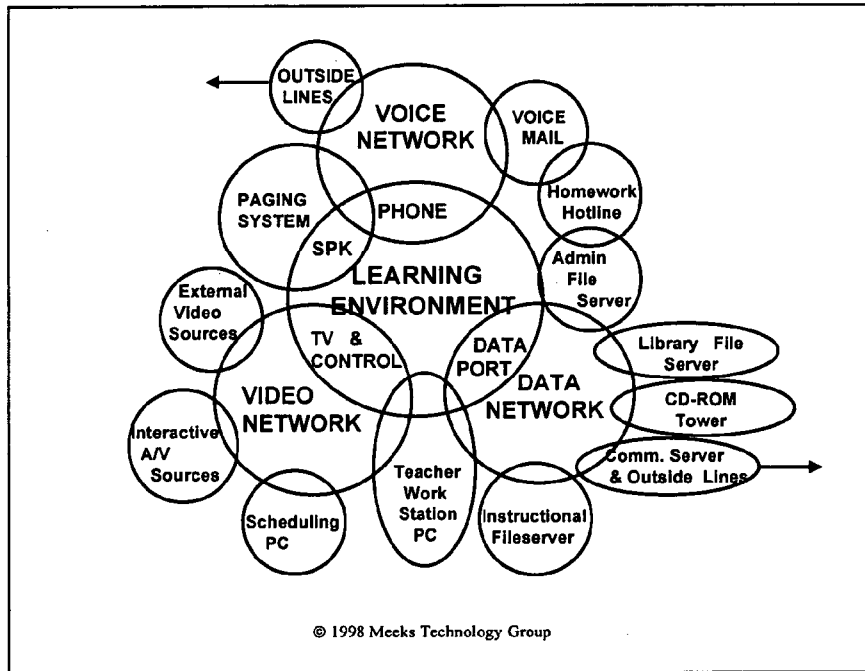
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TECHNOLOGY IN THE CLASSROOM

An Overview

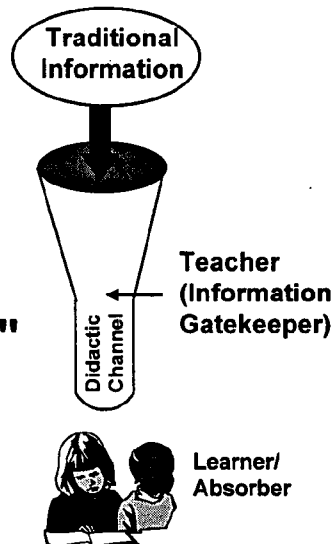
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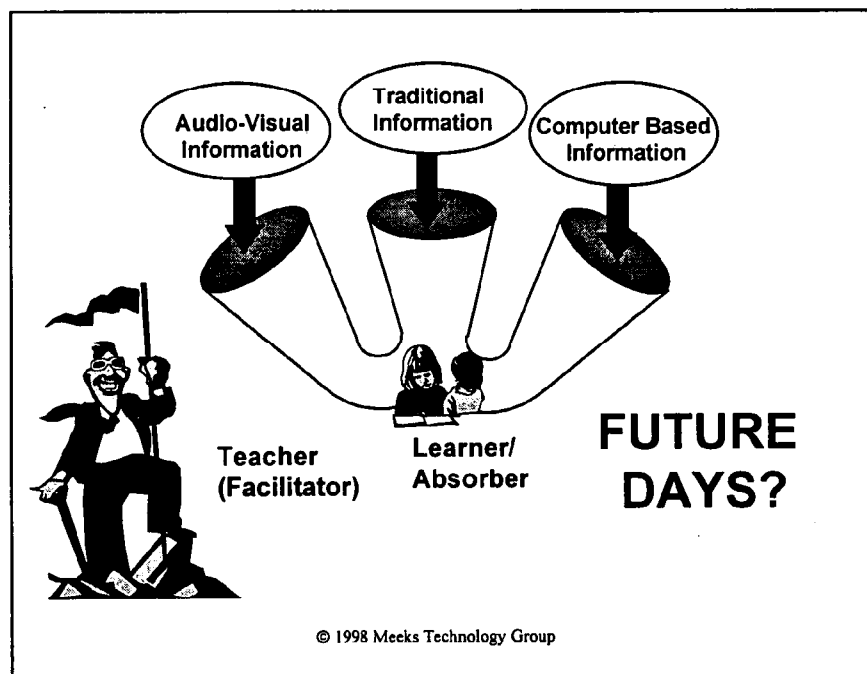
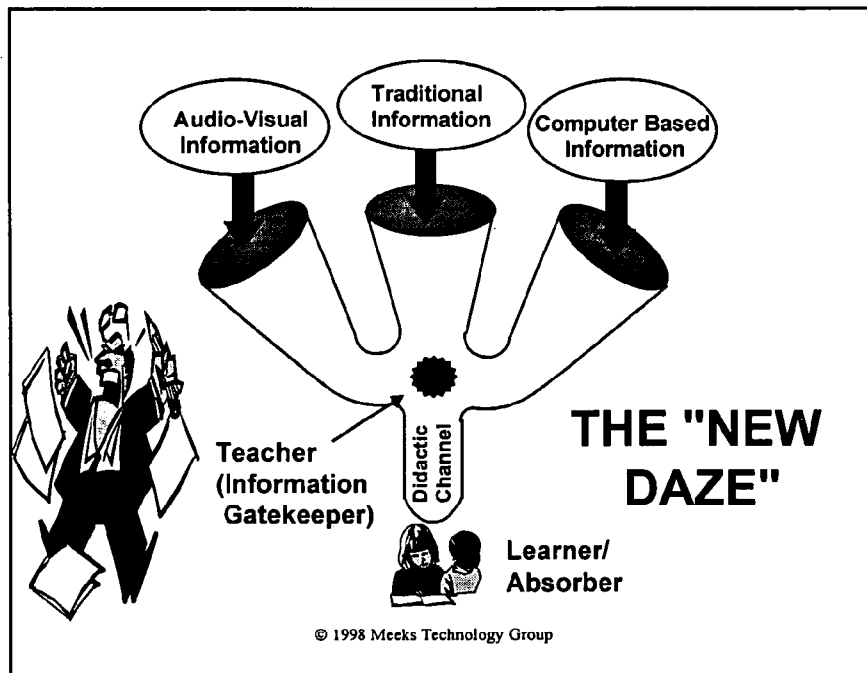
DOES TECHNOLOGY IMPROVE THE EDUCATIONAL PROCESS?

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THE "OLD DAYS"



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TECHNOLOGY CAN IMPROVE THE DELIVERY OF EDUCATION

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INSTRUCTIONAL TECHNOLOGY RESEARCH

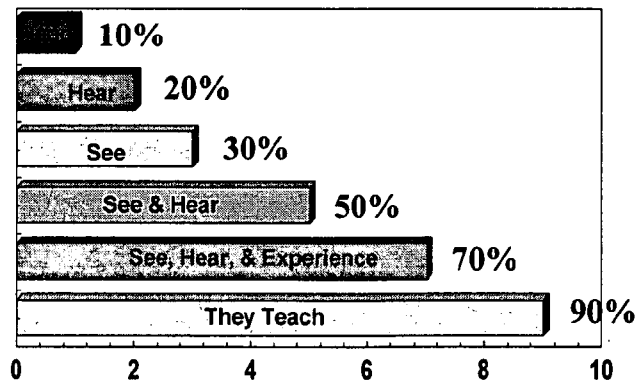
**BY: IESD, Sivin-Kachala & Bialo, The
"Effectiveness of Technology In Schools,"
1990-1996, Commissioned By SPA**

**BY: Various Educators, "Teaching Learning &
Technology," A Report on 10 Years of ACOT
(Apple Classrooms of Tomorrow)
1985-1995, Commissioned By APPLE**

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Learner Retention After Four Days

What They



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TECHNOLOGY COST CENTERS

What Does It Really Cost?

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PRIMARY CATEGORIES OF COSTS

- **INFRASTRUCTURE ★**
- **SYSTEMS ★**
- **STAFF DEVELOPMENT**
- **STAFF SUPPORT**
- **COURSEWARE**
- **MAINTENANCE & UPGRADES**

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INFRASTRUCTURE

- **TYPICALLY FUNDED AS CAPITAL PROJECT**
- **Electrical Power Requirements**
- **Cable Trays & Raceway for Cabling**
- **Special HVAC Requirements**

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SYSTEMS & CABLING

- **TYPICALLY FUNDED AS CAPITAL PROJECT**
- **Voice Networks**
- **Data Networks**
- **Video Networks**
- **Special Audio & Video Systems**

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STAFF DEVELOPMENT

- **FUNDED FROM OPERATING BUDGET**
- **In-Service Training on Technology**
- **Special Training Activities for Advanced Users (Release Time & Subs)**
- **Attendance of Regional & National Shows**
- **Time for Developing Applications**
- **Special Grant Funds for New Application Development / Experiments**

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STAFF SUPPORT

- **FUNDED FROM OPERATING BUDGET**
- **Technology Director Dedicated ONLY to Implement Plan - Instructional Focus**
- **Data Network Administrator**
- **Technology Technician(s) - Repair & Maintenance**
- **Building Level Technology Coordinator (Master Teacher?)**

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COURSEWARE

■ FUNDED THROUGH CAPITAL PROJECT

- Teacher Productivity Software
- Student Workstation Software
- Computer Lab Applications
- Library Automation Software
- Reference Resources (Computer & A/V)
- Curriculum Specific Software
- Curriculum Specific A/V Media

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MAINTENANCE & UPGRADES

■ FUNDED AS LINE ITEM IN YEARLY DISTRICT BUDGET

- Expansion of Video Network Resources
(Adding More VCR's, LD's, CD-Is, etc...)
- Expansion of Data Network Resources
- Upgrading Specific Computers for Specific Curriculum Tasks
- Replacing Obsolete Computers, Televisions, etc...

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MACRO BUDGET COSTS

- **Basic Cost Estimate Numbers (Includes Voice, Video, Data Systems; Infrastructure; Computers/Printers; Courseware)**
- **Per Student Basis - \$1500 to \$2000**
- **Square Footage Basis**
 - **Basic Systems @ \$3 to \$5/sq. ft**
 - **Maximized Systems @ \$7 to \$10/sq. ft.**
- **Instructional Stations Basis - Voice, Video Data w/1 Computer/Printer \$10,000/room.**
 - **With 6 Computers, \$25,000 per space**

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PUTTING IT IN PERSPECTIVE

- **Minimum Costs To Implement Technology Throughout the US.**
- **16,000 K-12 Districts**
- **Average Size = 2,750 Students**
- **Teacher / Student Ratio = 20:1**
- **One Teacher = One Instructional Space**
- **137.5 Instructional Spaces Per District**
- **2.065 Million Instruct. Spaces @ \$25K ea.**
- **\$51.6 Billion (Total Construction = \$12 Bil.)**
- **Does not include: Offices, Media Centers, Computer Labs, Applied Tech. Areas, etc...**

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TECHNOLOGY IMPLEMENTATION PROCESS



KEY ISSUES

- **Relationship Between Construction and Technology**
- **Categories of Purchases Related to Technology Implementation**
- **Implementation Overview**

**RELATIONSHIP BETWEEN
CONSTRUCTION PROCESS
& TECHNOLOGY
IMPLEMENTATION**

New Construction & Renovations

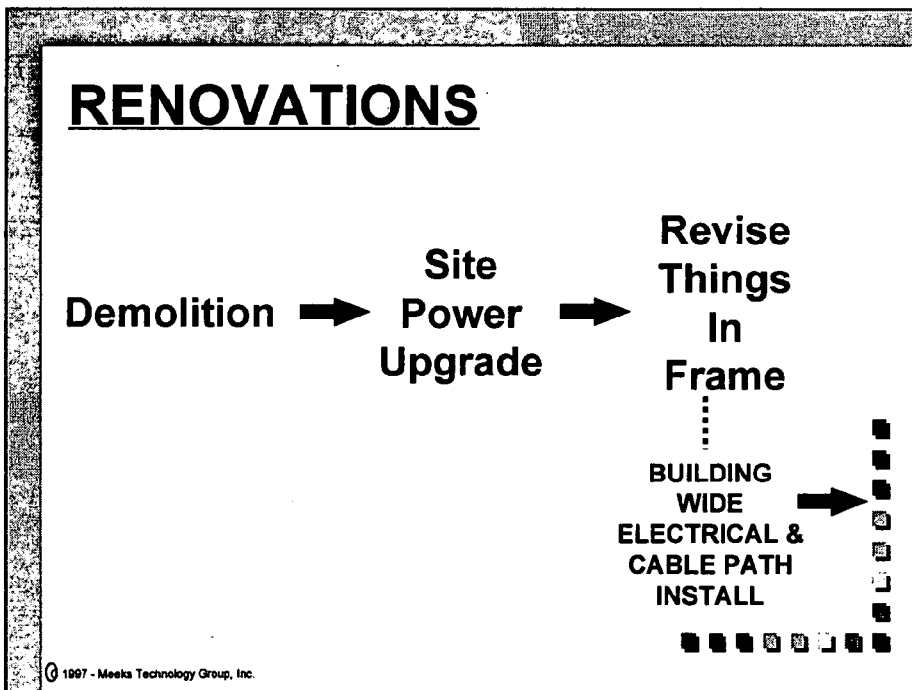
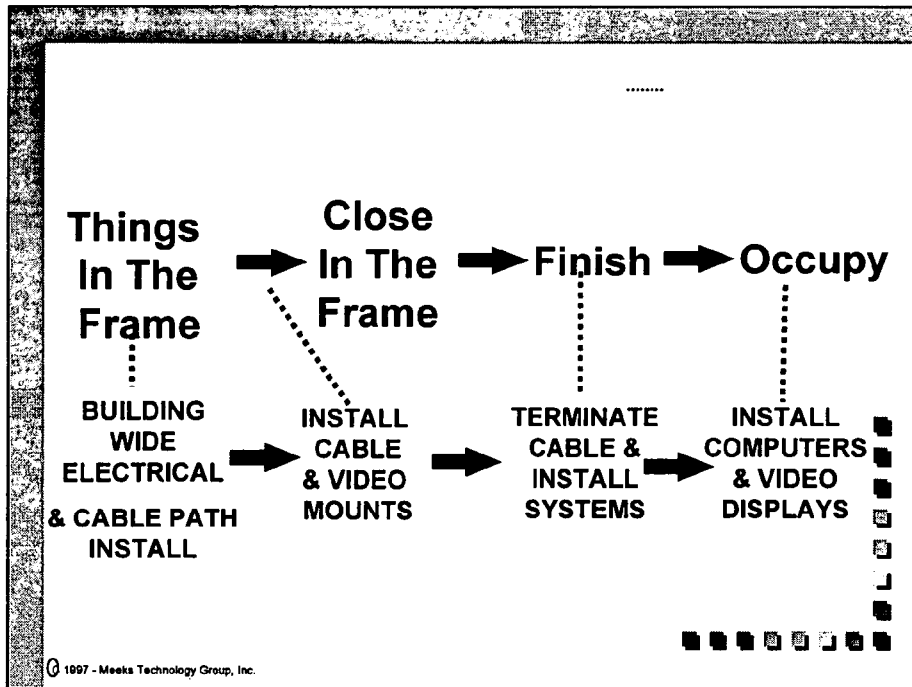
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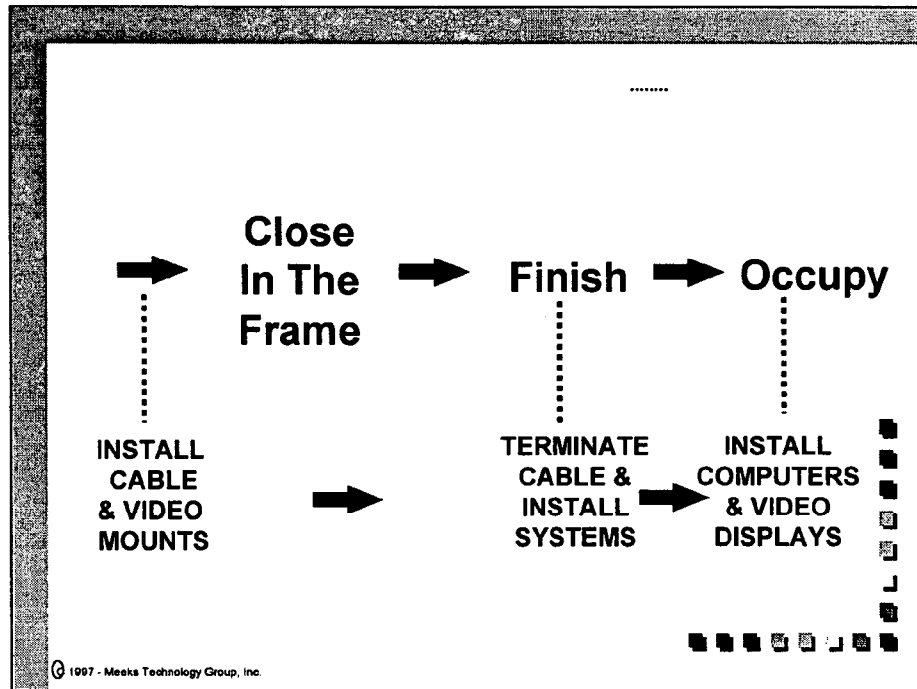
NEW CONSTRUCTION

Site Work → Foundation → Shell → Frame

BOXES & CONDUIT IN SLAB / EXTERIOR ENTRANCES

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THINGS OUT OF SEQUENCE

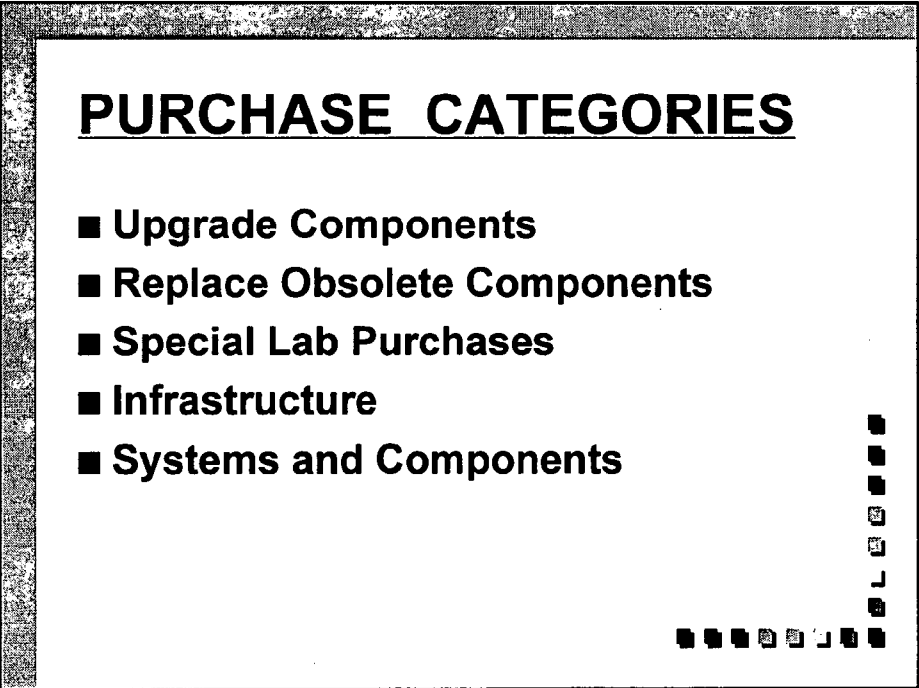
- Costs Much More
 - Costs Two To Three Times More
 - More Costs In the Walls (Not Seen)
 - Means Less Instructional Impact
- Susceptible To Damage By Later Construction Work
- Project Managment Inefficiencies



PURCHASE CATEGORIES FOR TECHNOLOGY IMPLEMENTATION

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PURCHASE CATEGORIES

- Upgrade Components
 - Replace Obsolete Components
 - Special Lab Purchases
 - Infrastructure
 - Systems and Components
- 

UPGRADE COMPONENTS

- | | |
|-----------------------|-----------------------------------|
| ■ Types of Technology | ■ Computer (RAM, Hard Drive, NIC) |
| ■ Implementation | ■ Direct By District |
| ■ Construction | ■ None |
| ■ Impact Area | ■ None |
| ■ Time Restriction | ■ None |

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REPLACE OBSOLETE COMPONENTS

- | | |
|-----------------------|------------------------------------|
| ■ Types of Technology | ■ Computer, Printer, Video Display |
| ■ Implementation | ■ Direct By District |
| ■ Construction | ■ None |
| ■ Impact Area | ■ None |
| ■ Time Restriction | ■ None |

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SPECIAL LABS

- Types of Technology
- Implementation
- Construction
- Impact Area
- Time Restriction
- Computer Lab, Science Lab
- District w/Electrician
- Electrical
- Local Area
- Infrastructure First

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INFRASTRUCTURE

- Types of Technology
- Implementation
- Construction
- Impact Area
- Time Restriction
- AC Power, Cable Paths, HVAC
- Architect, Engineer Consultant
- General Trades
- Facility Wide
- Based on Construction Process

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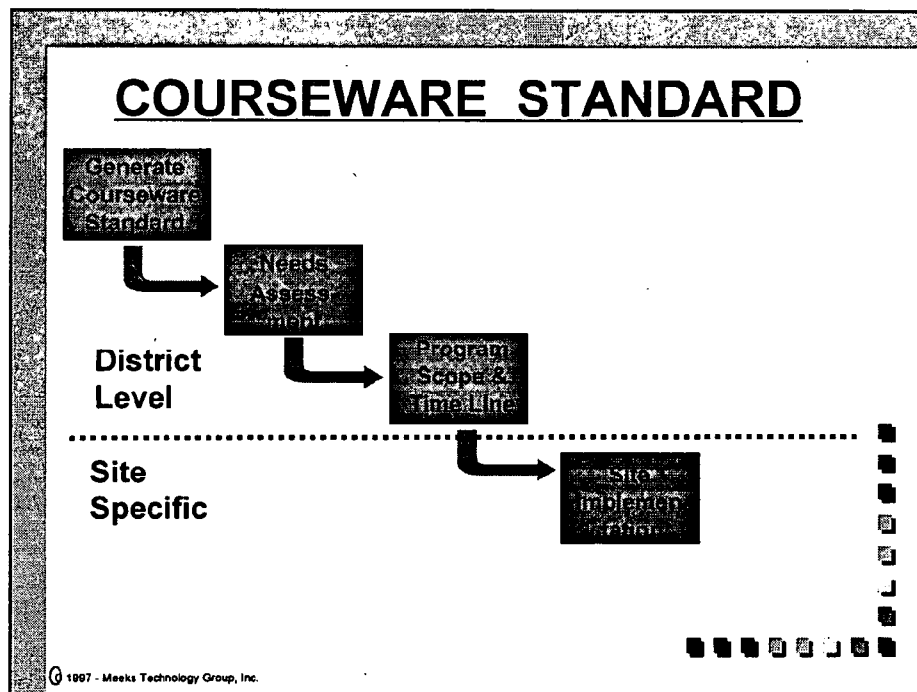
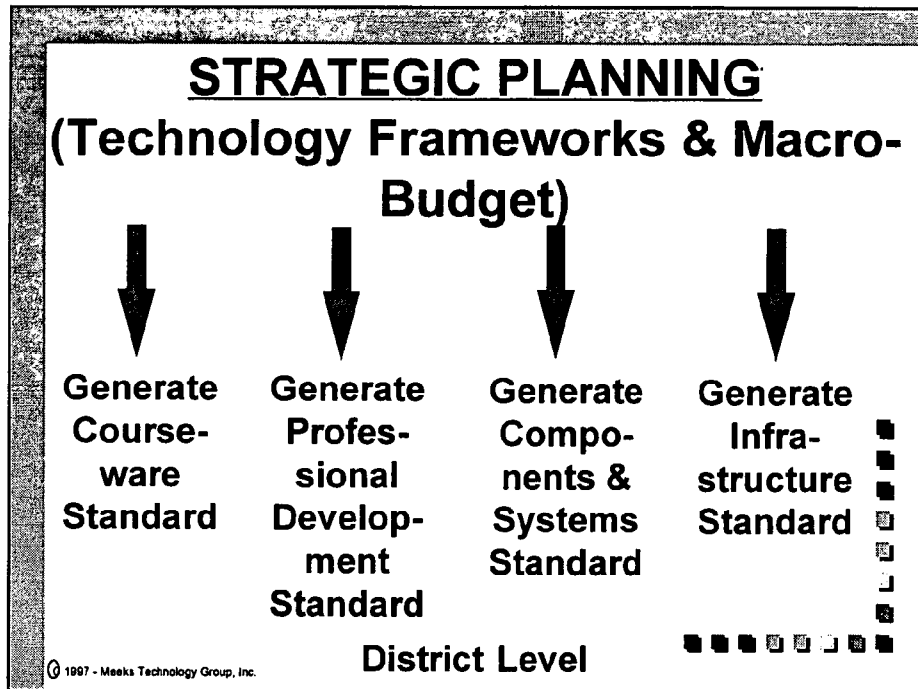
SYSTEMS & COMPONENTS

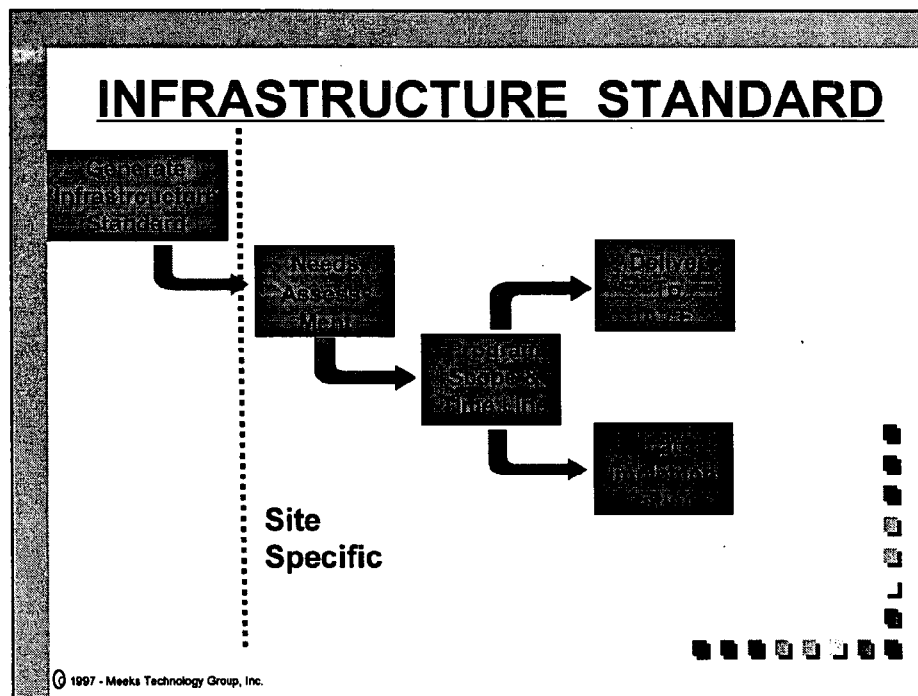
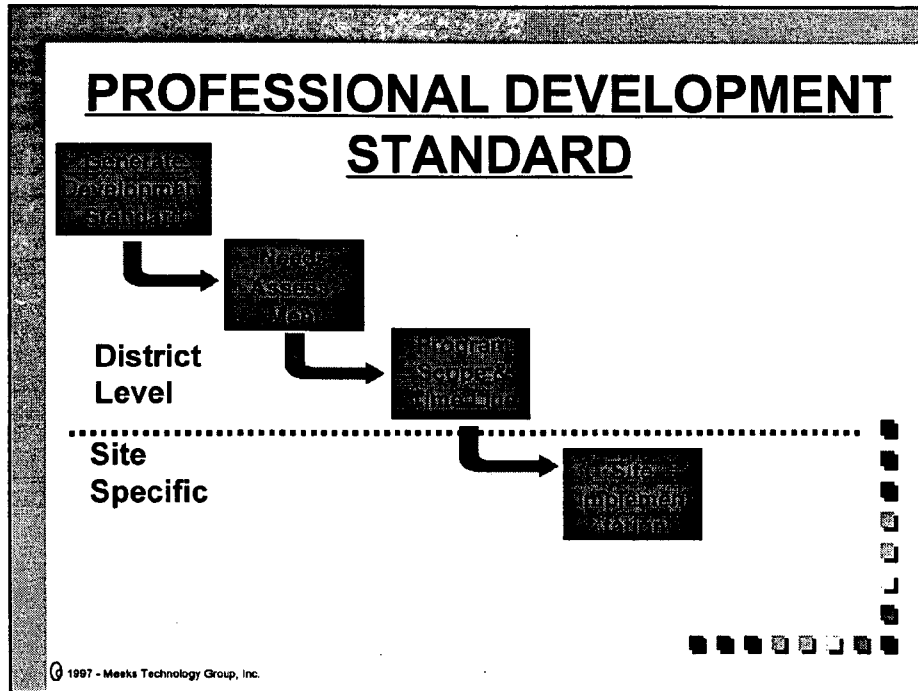
- Types of Technology
- Implementation
- Construction
- Impact Area
- Time Restriction
- Voice, Video, Data Systems
- Engineer, Consultant
- Technology Trades
- Facility Wide
- Follows Infrastructure

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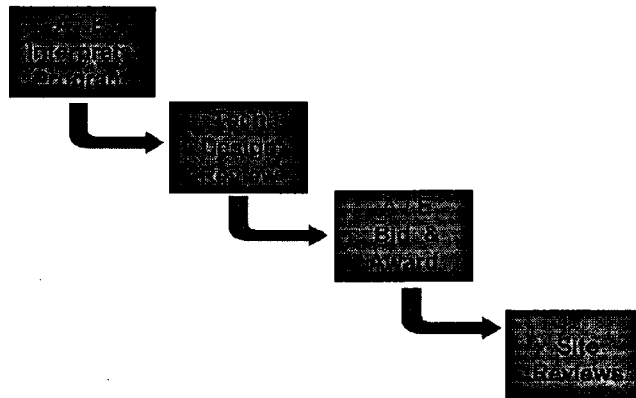
TECHNOLOGY IMPLEMENTATION PROCESS

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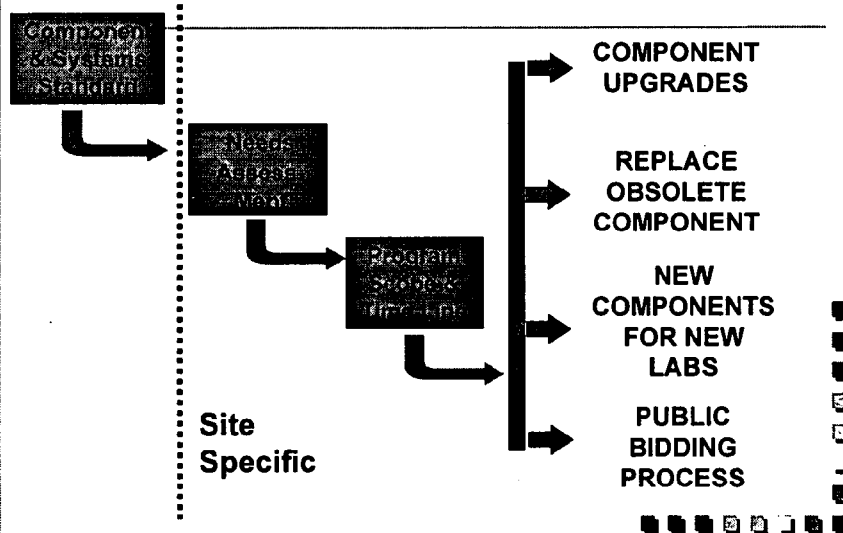


IMPLEMENT INFRASTRUCTURE

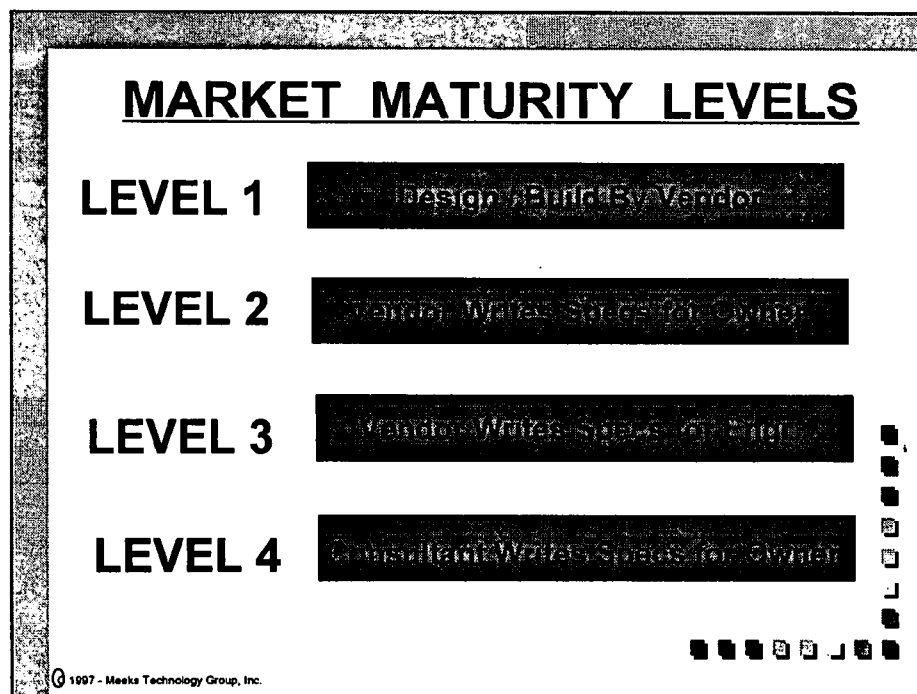
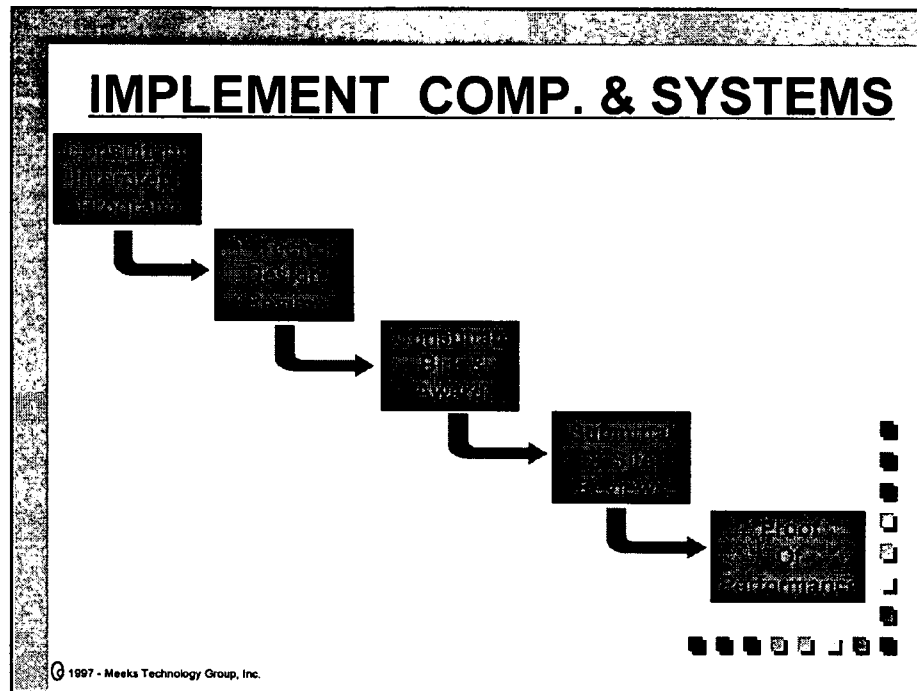


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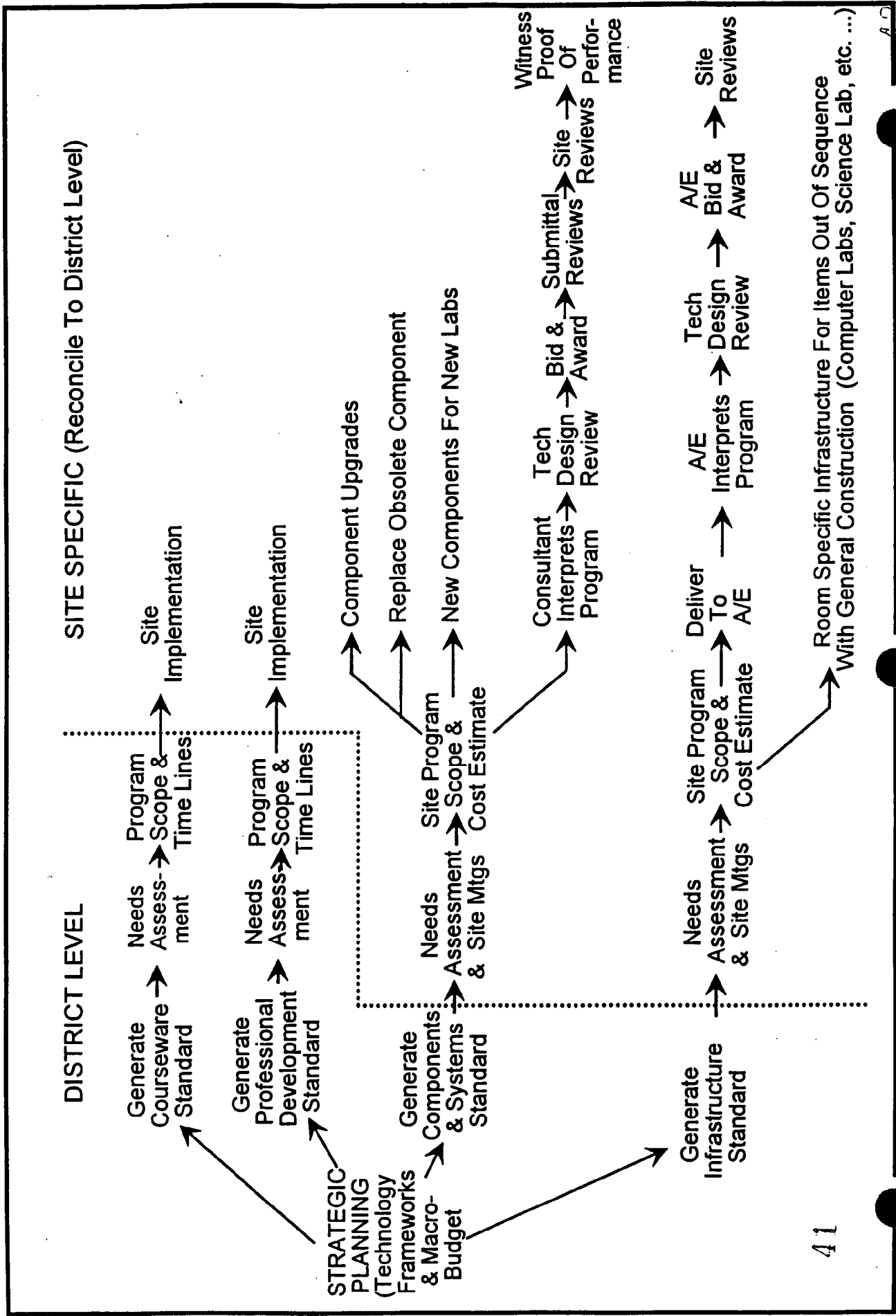
COMPONENTS & SYSTEMS



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TECHNOLOGY IMPLEMENTATION PROCESS



TECHNOLOGY IMPLEMENTATION CATEGORIES

<u>CATEGORIES</u>	<u>TYPES OF TECHNOLOGY</u>	<u>IMPLEMEN- TATION</u>	<u>CONSTRUC- TION</u>	<u>IMPACT AREA</u>	<u>TIME RESTRICTION</u>
UPGRADE COMPONENTS	COMPUTER (RAM, Hard Drive, Network Card)	DIRECT BY DISTRICT	NONE	NONE	NONE
REPLACE OBSOLETE COMPONENTS	COMPUTERS PRINTERS VIDEO DISPLAYS AV SOURCES	DIRECT BY DISTRICT	NONE	NONE	NONE
NEW COMPONENTS IN NEW AREA	COMPUTER LAB APPLIED TECH LAB SCIENCE LAB PRODUCTION CTR	DIRECT BY DISTRICT with ELECTRICIAN	ELECTRICAL	LOCAL INSTRUCTIONAL AREA	INFRASTRUCTURE OF LOCAL AREA MUST BE COMPLETED
NEW INFRASTRUCTURE	AC POWER CABLE PATH HVAC	DISTRICT AGENTS (Architect, Engineer, Consultant)	GENERAL TRADES	FACILITY WIDE	COMPLETION IS BASED ON CONSTRUCTION PROCESS
NEW SYSTEMS & NEW COMPONENTS	VOICE SYSTEMS DATA SYSTEMS VIDEO SYSTEMS	DISTRICT AGENT (Engineer, Consultant)	TECHNOLOGY TRADES	FACILITY WIDE	COMPLETION IS BASED ON COMPLETION OF INFRASTRUCTURE



TECHNOLOGY PLANNING PARALLELS THE ARCHITECTURAL PROCESS

**The Instructional Technology Program
Requirements**

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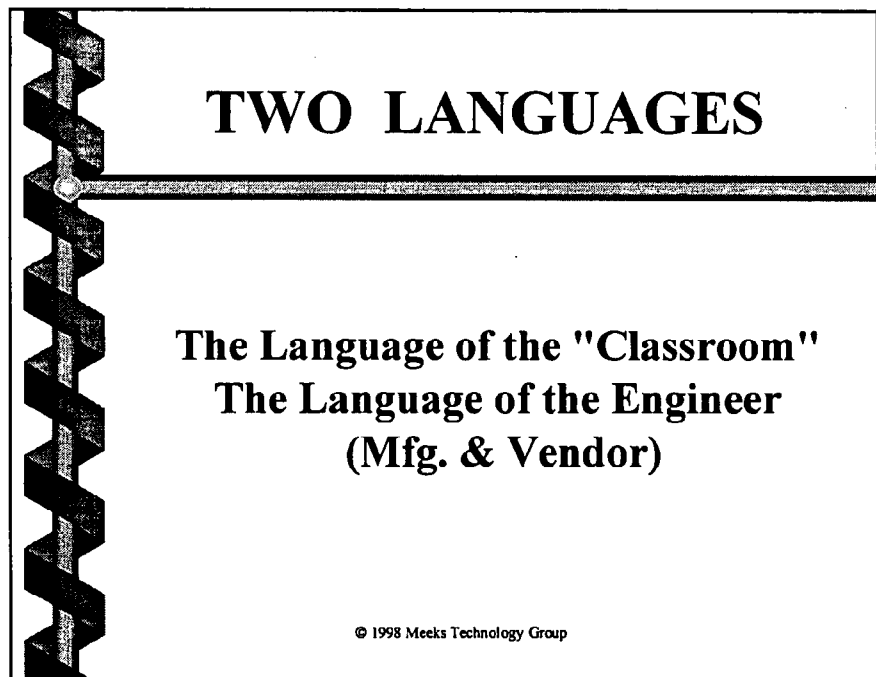
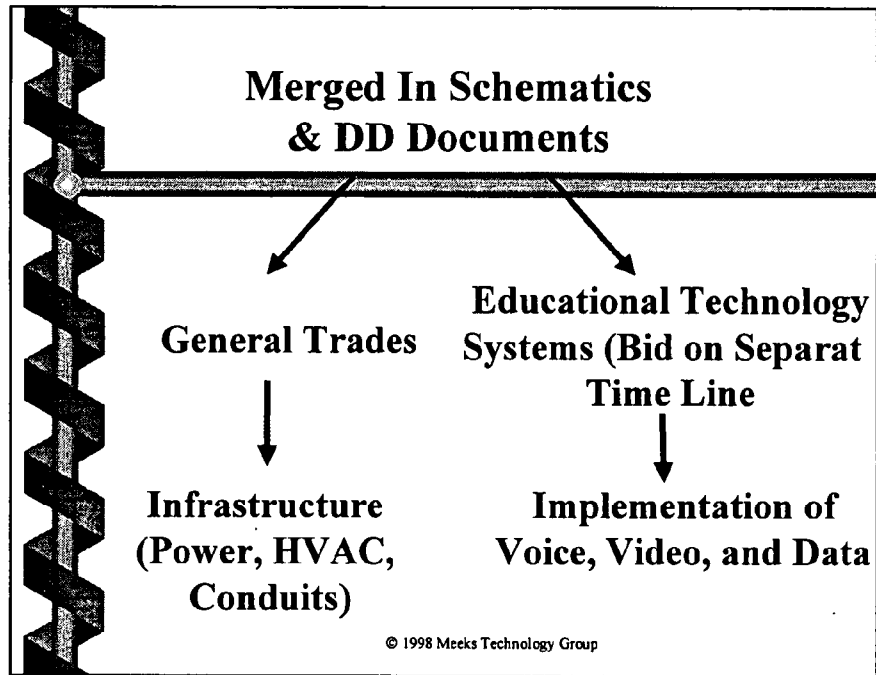
INSTRUCTIONAL PROGRAM REQUIREMENTS

**Const. Program
Bldg. Design
(Interactive Basis)**

**Technology Plan Is
Developed
(Interactive Basis)**

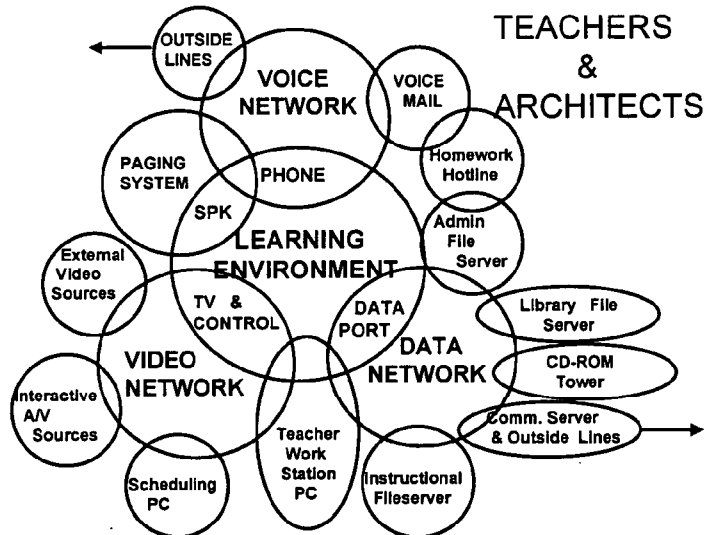
**Merged In Schematics
& DD Documents**

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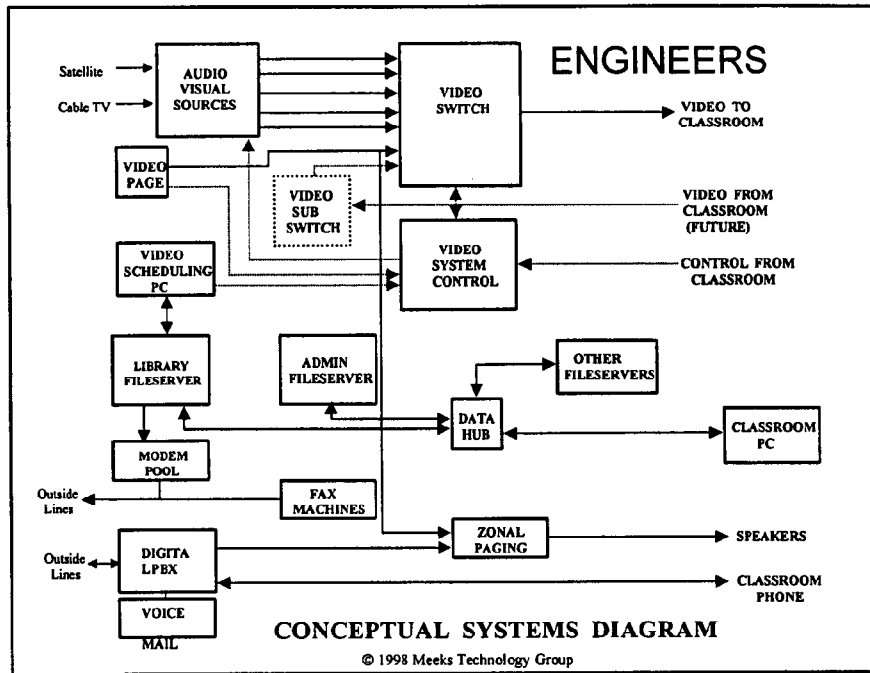


- Arch./Planner Understands the "Business" of the Classroom.
- Uses an Interactive Process to Determine Needs
- Direct Translation of User Needs
- Owner Buy In Occurs
- Engineer Does Not Understand the "Business" of the Classroom.
- Calculates an Outcome (Does Not Use An Interactive/ People Process).
- Subject to Misunderstanding.
- No Buy-In

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TECHNOLOGY MASTER PLANS

Building The Roadmap

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Technology Changes the Business of the Classroom

**The Majority of Teachers Have NOT
Received Training Regarding How TO
Use Instructional Technology In The
Classroom (Presentation or Project
Based)**

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IMPEDIMENTS TO CHANGE

- **TIME**
- **SPACE**
- **MONEY**
- **ATTITUDES**
- **APPLICABLE TECHNOLOGY**

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The Primary Method to Assist People Embrace Change

Create a Sense of Ownership

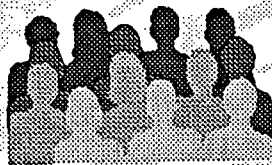
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OWNERSHIP

**The Users Of Technology
(or their representatives)
Must Have Input Regarding The
Issues Impacting Their Business
(instruction in the classroom)**

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PLANNING PARTICIPANTS



**COMMUNITY
(Parents, Business)**



**STAFF (Technological
and Non-Technological)**



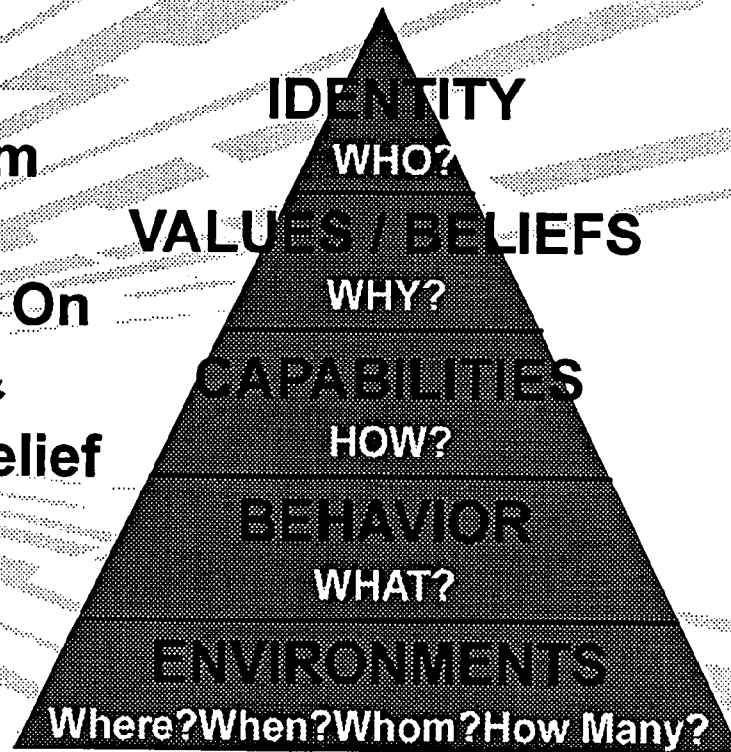
Students



Board

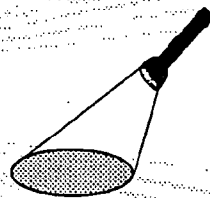
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**Effective
Long Term
Planning
Focuses On
Identity &
Values/Belief**



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PROCESS (Continued)



AWARENESS



WHY PHONE?

WHY COMPUTER?

WHY VIDEO?

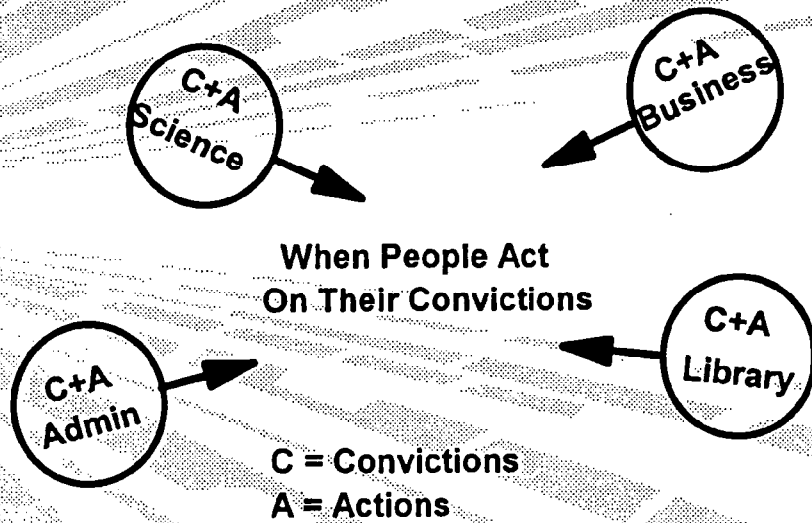
**WHO ARE YOUR
CLIENTS?**

**WHAT SKILLS/KNOW.
DO THEY NEED?**

HOW TO USE TECH.?

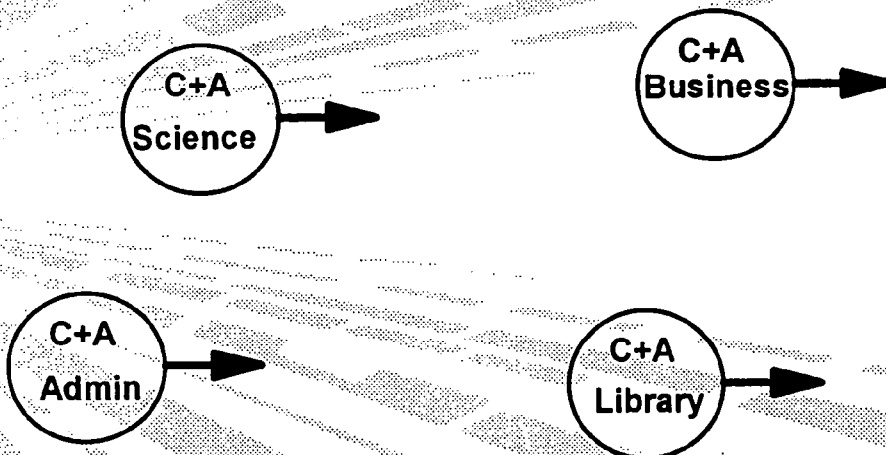
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WHEN A VISION DOES NOT EXIST



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VISION ALIGNS ALL ACTIONS



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PROCESS (Continued)

DISTRICT ISSUES

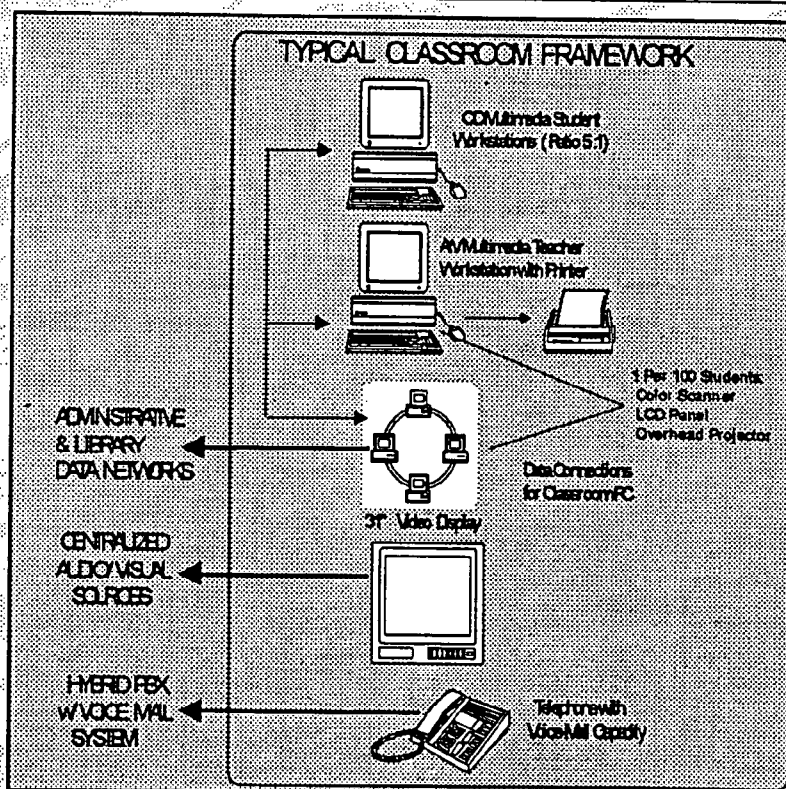
(The Hindrances
and Roadblocks,
Political and
Personnel.)



TECHNOLOGY FRAMEWORKS

(Technology Ed
Specs of Every
Space In Every
Facility.)

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©1996 Meeks Technology Group

PROCESS (Continued)

**IDEAL COST
ESTIMATE**
(Long Term
Funding Re-
quirements)



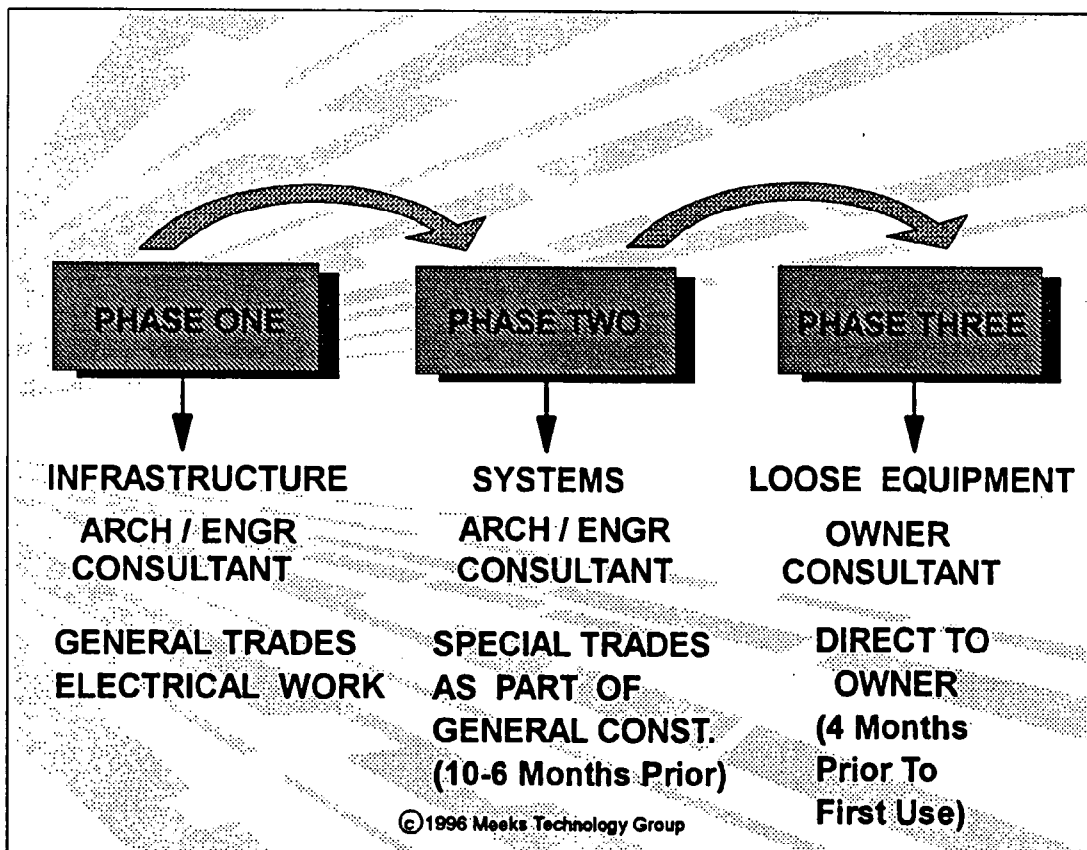
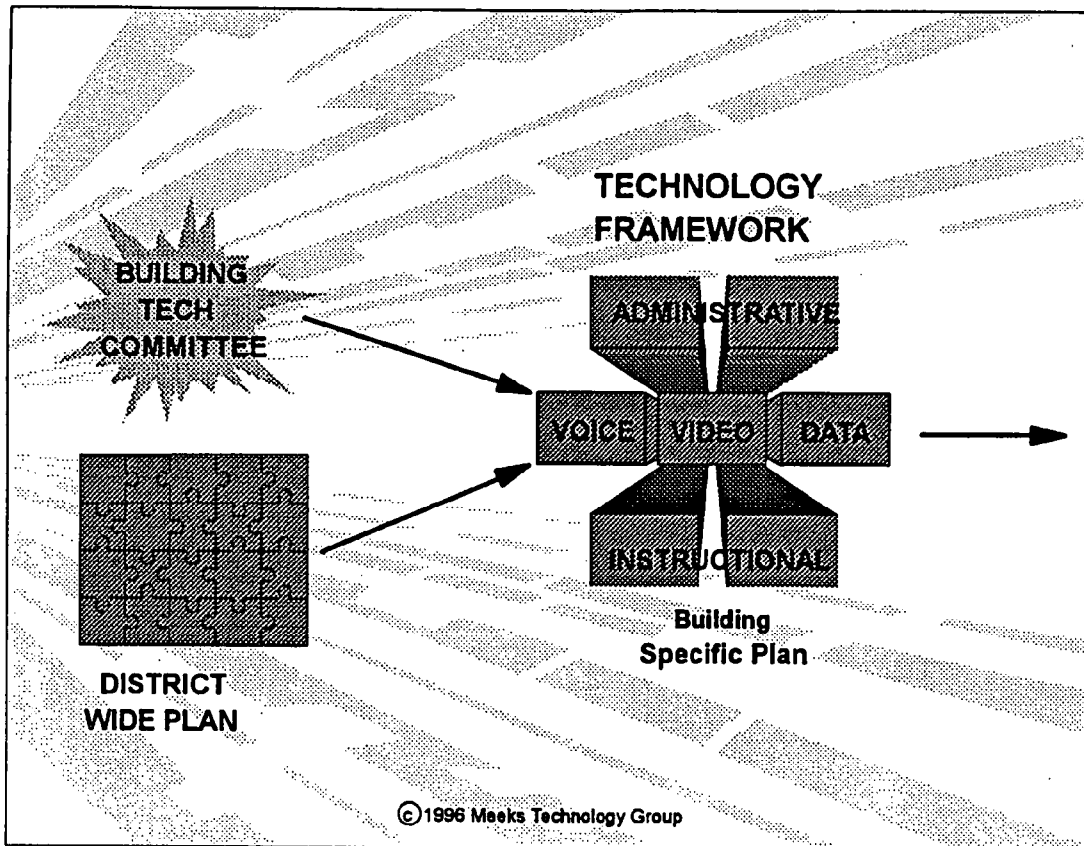
DISTRICT GOAL
(Real Funds
Available Placed
Into A Timeline.)

Process Takes Two 2 Day Planning Labs and a
Total of 90 Days From Initializatoin To Completion.

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BUILDING SPECIFIC TECHNOLOGY PLAN

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INFRASTRUCTURE

(Thirty or Forty Year Issues/Money)

- **Locate All Potential Technology Points in Building**
- **Provide AC Power As Required**
- **Provide Cable Access As Required**
- **Meet HVAC Needs**

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TECHNOLOGY SYSTEMS

(Ten Year Issues/Money)

- **Provide Bid Documents For System Which Support Goals (Voice, Video, and Data Systems)**
- **Provide Cabling With Systems**
- **Provide Training With Systems**

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LOOSE EQUIPMENT (Three Year Issues/Money)

- **Computers and Printers**
- **Courseware**
- **Library Systems**
- **Applied Technology Systems**
- **Special Applications**

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SUPPORT STAFF ORGANIZATION

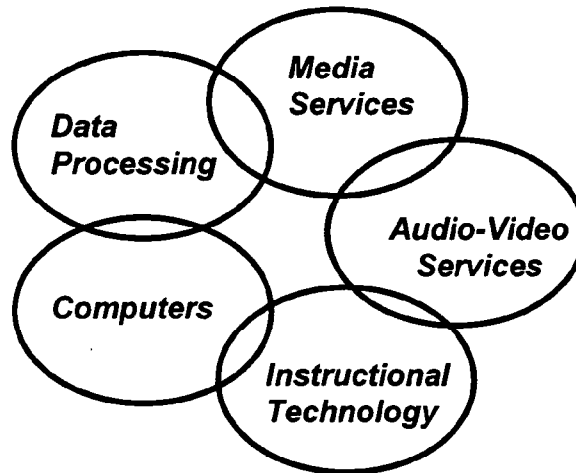
**EDUCATIONAL TECHNOLOGY
SYSTEMS & SUPPORT**



Technology Causes Overlap and Blurring of Traditional Support Categories

Duplicate Purchases - Incompatibility Issues

Who Is Responsible?



Maximizing Technology Purchasing Power

*Reorganize Support Structure
to Eliminate Duplication
and Incompatibility Issues*

LARGE / SMALL DISTRICTS

■ **Larger Districts**

- *Dedicated - Full Time Position*
- *Multiple Specialists in Support of Leader*

■ **Smaller Districts**

- *One Person Wears Multiple Hats*
- *Very Few Specialists*

Regardless Of Size, All Function Areas Require Attention.

DIRECTOR OF TECHNOLOGY

- *Responsibility and Authority For All Areas Related to Technology*
- *Instructional Orientation*
(Majority of Funds Are Spent In The Instructional Areas)
- *Strong Management Skills*
- *Strong Communications and People Skills*

RESPONSIBILITIES

- *Articulate and Maintain Vision For Technology*
- *Oversee Tech. Systems and Support*
- *Yearly Technology Budget Requests*
- *Coordinate Tech. Support With Other Areas Within District*
- *Oversee Hardware and Software Purchases*
- *Facilitate Policy Definitions*

REMAINING STAFF OVERVIEW (2 CAMPS)

- | | |
|---|--|
| <ul style="list-style-type: none">■ <i>Things People</i><ul style="list-style-type: none">• <i>Voice, Video, and Data Components & Networks</i>• <i>Computers</i>• <i>Cabling</i>• <i>Repair</i> | <ul style="list-style-type: none">■ <i>People People</i><ul style="list-style-type: none">• <i>Staff Development</i>• <i>Matching Curriculum and Content</i>• <i>Assessment and Evaluation</i> |
|---|--|

DIRECTOR OF SYSTEMS SUPPORT

- *Working Knowledge of Voice, Video, and Data Systems*
- *Basic Knowledge of Education Environment*
- *Strong Management Skills*
- *Good Communications and People Skills*

RESPONSIBILITIES

- *Review Hardware and OS Software Purchases for Compatibility Issues*
- *Data Network Systems*
 - *Computer Repair and Maintenance*
- *Voice Systems*
- *Audio-Visual Systems*
 - *Phone & A/V Repair and Maintenance*
- *Co-Management of Help Desk*

IS SPECIALIST

- *Maintains Administrative Computing Servers and Software*
 - *Data Processing (Financials)*
 - *Student Services*
 - *Transportation*
- *Answers to Business Manager and Director of Technology Systems*

NETWORK ADMINISTRATOR

- *Maintains Instructional Servers and Related Software & Distribution*
- *Maintains Building Level LANs*
 - *Network Software (Directory Trees and IP Addressing - Internet Access)*
 - *Hubs, Switches, Router*
 - *Workstations Operating on LAN*
- *Maintains WAN*
- *Review Hardware Purchases*

COMPUTER REPAIR/MAINT.

- *Operates in Support of Network Administrators*
- *Responsible for Repair and Maintenance of All Computers, Monitors, Printers, and Related Peripherals*

VOICE SYSTEMS

- *Management of All Voice Systems*
 - *Phone Systems*
 - *Voice-Mail Systems*
 - *Intercom / Paging Systems*
- *Maintenance and Repair of Primary Systems*
- *Software Updates, Changes, Moves*

VIDEO SYSTEMS

- *Management of Video Systems*
 - *Video Distribution Systems*
 - *Media Retrieval*
 - *Distance Learning Systems*
 - *Video Production Systems*
- *Management of A/V Components*
 - *Displays - TVs, Projectors, etc..*
 - *A/V Sources - VCR, LD, DVD*

A/V REPAIR & MAINTENANCE

- *Operates in Support of Voice and Video Systems Personnel*
- *Repair and Maintenance for:*
 - *Phone System and Components*
 - *Intercom Systems*
 - *Video Systems*
 - *Displays*
 - *A/V Sources*

SYSTEMS - HELP DESK

■ Real Time Help for Issues Related To:

- ***Desktop Operating System***
- ***Desktop Hardware Issues***
- ***Administrative Software***
- ***E-Mail***
- ***Data Network Functions***
- ***Voice System Functions***
- ***Video System functions***

DIRECTOR OF STAFF SUPPORT

- ***Thorough Understanding of Curriculum and Instructional Program Functions***
- ***Prior Experience of Integrating Technology Into Curriculum***
- ***Prior Experience In Staff Development***
- ***Strong Management Skills***
- ***Good Communications and People Skills***

RESPONSIBILITIES

- *Review Courseware Purchases Matched to Curriculum/Instruction*
- *Manage Media Center and Services*
 - *Building Level Media Centers Services*
- *Manage Staff Development*
 - *District Level*
 - *Building Level*
- *Co-Management of Help Desk*

DISTRICT MEDIA CENTER

- *Setting Standards For All Media Centers*
- *Integration of Technology Into Media Centers and Related Services*
 - *Library Automation Systems*
 - *References - CD-ROM Tower, Etc...*
 - *Production Systems*

CAMPUS MEDIA CENTERS

- *Operates in Support of Information Delivery to Instructional Program*
- *Management of Campus Media Centers*
 - *Maintaining Records*
 - *Assist Users of Automation System*
 - *Operation of Productions Centers?*
 - *Maintain Reference Materials Which Are Not Paper Based*
 - *Copyright Policy*

STAFF DEVELOPMENT and TECHNOLOGY INTEGRATION

- *Areas of Training*
 - *Basic Technology Trouble Shooting*
 - *Standard Productivity Software (WP,DB,SS)*
 - *Internet Access and Use*
 - *Instructional Applications*
 - *Curriculum / Instructional Management*
 - *Assessment and Evaluation*

CAMPUS LEVEL STAFF DEVELOPMENT PERSONNEL

- *Operates as Campus Level Extension of District "SD and TI".*
- *Available When Instructor Needs Help*
- *Total Focus On Integration of Technology, Via Any and All Methods, Into The Typical Classroom*

STAFF SUPPORT - HELP DESK

- *Real Time Help for Issues Related To:*
 - ***Standard Personal Productivity Software (WP, SS, DB, DTP)***
 - ***Instructional Software***
 - ***Curriculum / Instructional Management Software***
 - ***Internet***



TECHNOLOGY Infrastructure/Cabling

Preparing Your Building

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AC POWER - AREAS OF CONCERN

- Major Voltage Drops
- Major Power Spikes and Surges
- Harmonic Feedback

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VOLTAGE DROPS & SURGES

- **Voltage drops will cause computer to act like it has been turned off and back on.**
 - **Separate computer power from HVAC systems.**
 - **Install constant voltage transformer (expensive).**
- **Voltage spikes can damage power supply or components of the computer.**
 - **Use MOV (Metal Oxide Varistor) surge protectors.**

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HARMONIC FEEDBACK

- **Computer Power Supplies Generate Harmonic Feedback on Neutral Circuit.**
 - **One neutral conductor for every hot conductor or oversize neutral by 200%.**
 - **Electrical panel to transformer neutral must be oversized.**
 - **Provide transformers with correct "K" rating, minimum K-4. K rating means a larger secondary winding.**

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TECHNOLOGY POWER IN THE CLASSROOM

■ Therefore, Items Which Are No Longer A Concern.

- Isolated ground outlets (special outlets).
- Isolated ground circuits and transformers.
- Separation of convenience power (general use power) and technology power within the classroom.

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TYPICAL POWER NEEDS

- | | |
|----------------------------|-----------------------|
| ■ Pentium Comp. -
1.25A | ■ 5ppm Laser - 1.5A |
| ■ 15"-17" Monitor - 1 A | ■ 12ppm Laser - 2.5A |
| ■ 21" Monitor - 1.5A | ■ 31" TV - 3A |
| ■ Pentium Portable | ■ Data Projector - 6A |
| with CD-ROM- .5A | ■ HP III Laser - 7.6A |
| ■ Ink Jet Printer - .25A | ■ Apple IIE - 4.5A |

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CLASSROOM POWER NEEDS

■ AC Power Requirements

1- 20 amp circuit handles six computers and one laser printer. Use power strips w/surge protection and noise filtering.

1- 20 amp circuit handles thirty- two pentium laptops w/CD-ROM and sound card.

■ Video Components

Provide four amps per room for video monitor, control system, and LCD panel w/overhead.

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THEREFORE:

■ TYPICAL CLASSROOM (25 Students)

Two 20 amp circuits for general use and technology power - today and tomorrow. (Desk tops today, laptops tomorrow.)

■ TYPICAL COMPUTER LAB (25 Students)

Six 20 amp circuits for todays desk top computers and general power. However tomorrows laptops need only two circuits per room.

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HEADEND POWER NEEDS

- **Fileservers and Network Components**
Provide 4 amps per fileserver, 1 amp per network component. All components are served by a UPS.
- **Video Information System**
2 - 20 amp circuits for first two racks and one 20 amp circuit for every two racks thereafter.
- **Telephone**
1 - 20 amp circuit. Provide surge protection for all trunks (telephone & data) entering building.

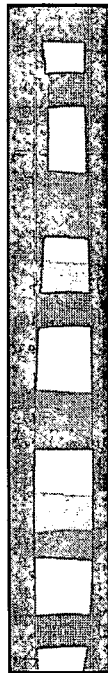
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HVAC REQUIREMENTS

- **Classroom**
5 computers raise HVAC cooling needs by 25%.
20 computers will double HVAC cooling needs.
- **Headend**
All headend rooms are cooled "YEAR ROUND".
Small systems require 5,000 btu cooling capacity.
Large headends require 12,000 btu capacity.

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CABLE TRAYS and CONDUIT

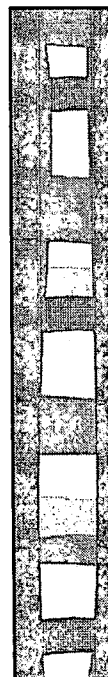
■ Primary Cable Runs

- Cable Trays (Mono Support Systems)
- Wireways
- Cable Supports (Bridle Rings) Typical for Renovations/Retrofits

■ Classroom Cable Runs

- Three sleeves (1.25") in hallway wall
- In- wall conduit stubbed above ceiling (Stubs should have nylon bushings over ends)
- Surface mounted wireway and wiremold

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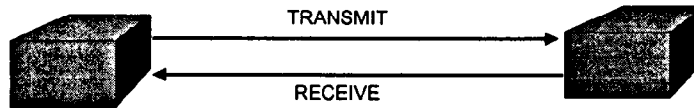


CABLE ROUTE LAYOUTS

**Methods For Connecting
Devices**

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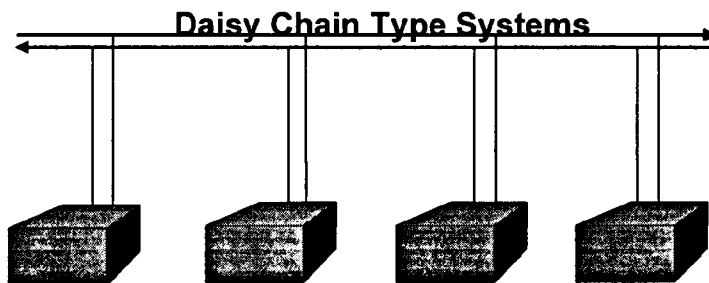
POINT - TO - POINT (Home Run Cabling)



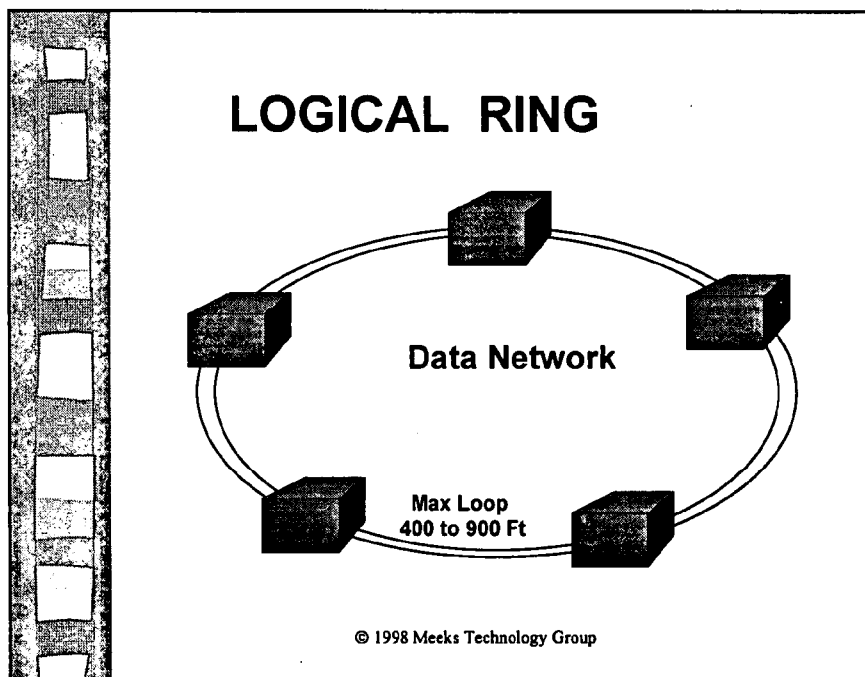
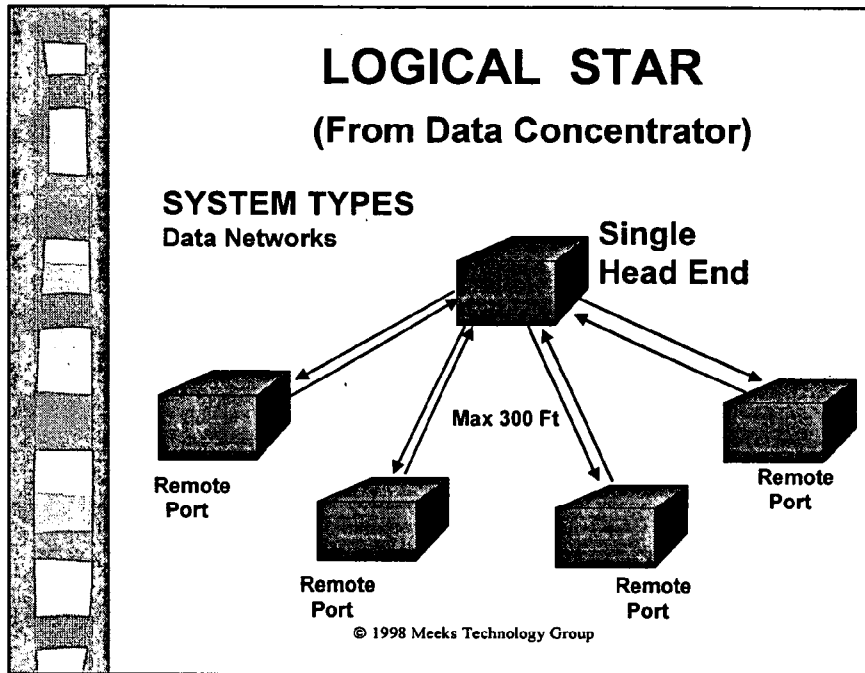
SYSTEM TYPES
Video Networks
Modem Access Lines
Telephone Networks

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BUS WIRING (Traditional Ethernet)

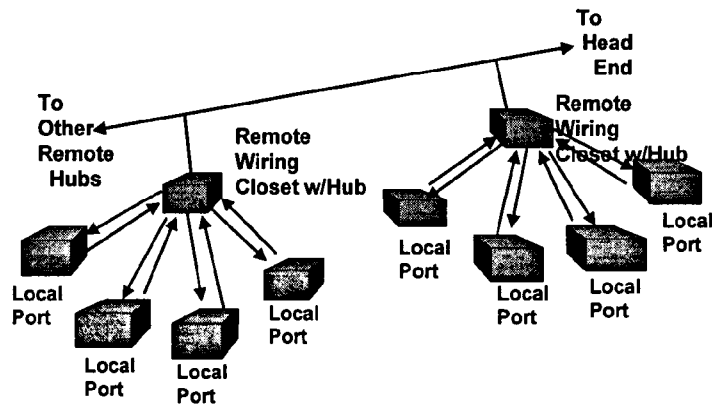


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BUS and LOGICAL STAR

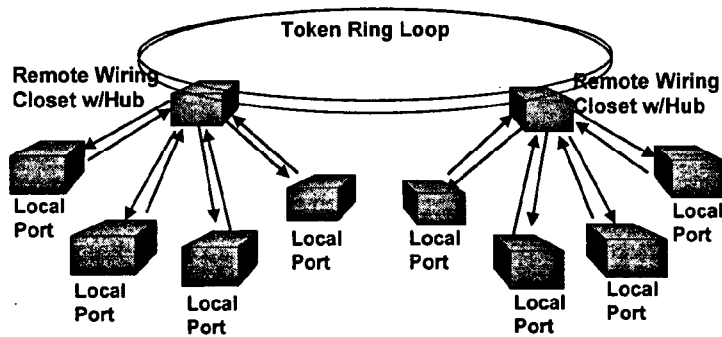
(Ethernet with remote concentrators/hubs)



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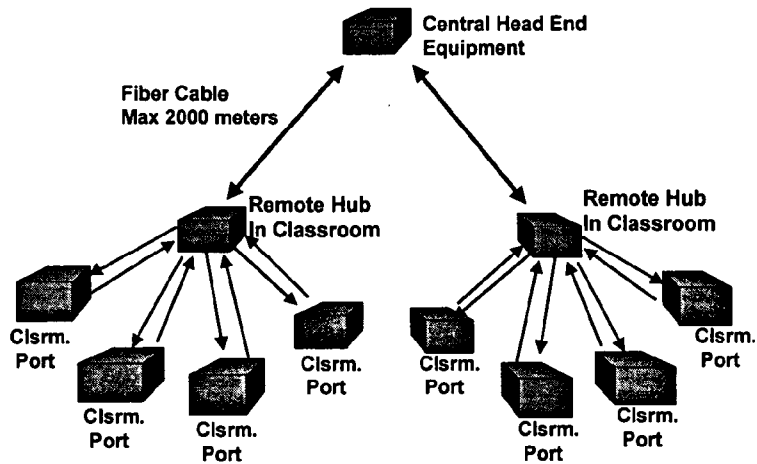
RING and LOGICAL STAR

(Typical Token Ring with MAU or CAU Units)



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COLLAPSED BACKBONE



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COST COMPARISON

■ Distributed Ethernet (Wiring Closets)	■ Collapsed Backbone
- 4 Cat 5 @ 200 Ft	- 4 F.O. Strands @200 Ft.
- 20% Wastage = 40 Ft	- 20% Wastage = 40 Ft
- 960 Ft @ \$.38/Ft (\$365)	- 240 Ft @ \$.95/Ft (\$228)
- 8 hours/1000 Ft	- 8 Hours / 1000 Ft
- @ \$40/hr (\$320)	- 2.5 hrs @ \$40/hr (\$100)
- Total Cost \$685	- Total Cost \$328
- Contractor Mark-up 1.4	- Contractor Mark-up 1.4
- \$959	- \$460

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PRIMARY INFLUENCE ON NETWORK CAPACITY

**HOW LARGE ARE THE FILES
WE SEND ACROSS THE
NETWORK?**

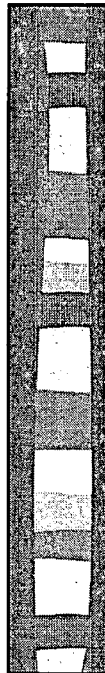
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A REVIEW OF FILE SIZES

- E-Mail (1-2KB) 1986
- Single Page Spreadsheet (15-20KB) 1986
- Word Processor Document (5pg) (20-40KB)
- 60 Page Integrated Document (1 MB)
- MS Office "Binder" SS,WP (400KB)
- Multimedia documents (Audio, Video, Graphics, Text, Spreadsheets, Animation) (5-10MB)

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EXPECTED FILE SIZES


IF

■ 1986 - 10KB	■ 1996 - 1MB
---------------	--------------

THEN

■ 1996 - 1MB	■ 2006 - 10GB
--------------	---------------

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FILE SIZE AND DELIVERY SPEED

- 1MB Internet File At 28.8Kbps (10 Minutes)
Throughput = 1.66 Kb/s
- 1 MB File on 10Mb/s Ethernet (10 Seconds)
Throughput - 100Kb/s
- Keith Sweat MTV Video
 - 2.4 Kb/s Modem (46 hours 40 minutes)
 - 28.8 Kb/s Modem (4 hours 45 minutes)
 - ISDN - 128 Kb/s (1 hour 12 minutes)
 - T-1 - 1.54 Mb/s (5 minutes)
 - 6 Mb/s Cable Modem (85 seconds)

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THE ISSUE IS SPEED

How Do We Obtain That
Speed?

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TYPES/SPEED OF DATA NETWORKS

- LocalTalk (Apple) (256Kbs)
- Baseband (1Mbps)
- Ethernet Thinnet (10Base2) (10Mbps)
- Ethernet Twisted Pair (10BaseT) (10Mbps)
- Token Ring (16Mbps)
- Fast Ethernet (100Mbps)
- Gigabit Ethernet (1Gbps)
- Asynchronous Transfer Mode (ATM)
(25 Mbps, 50Mbps, 100Mbps, 155Mbps
Up to 2.6 Gbps)

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EXPECTED NETWORK SPEED REQUIREMENTS

IF

■ 1986 - 1.2Kb/s

■ 1996 - 10Mb/s

THEN

■ 1996 - 10Mb/s

■ 2006 - 100Gb/s

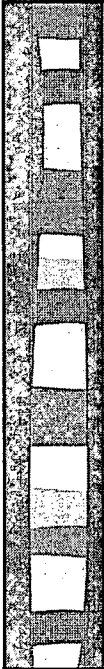
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WIRELESS NETWORKS

How Do They
Measure Up?

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THERE ARE TWO BIG PROBLEMS FOR WIRELESS SYSTEMS IN BUILDINGS.

- **Law of Supply and Demand**
 - **Users Will Pay a Fee**
- **Speed**
 - **AT&T - PCS Digital Service - 2400 bps**
 - **Area Wide Radio Frequency Systems - 1 Mb/s**
 - **Fastest Infrared Dome - 1Mb/s**
 - **First 10Mb/s RF System was Recalled.**
- **Wireless Will Always Lag Behind Cable.**

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BETWEEN BUILDINGS (WAN)

Wireless systems are available up to speeds of 10 Mb/s at reasonable prices and distances up to 20 miles. Therefore, wireless systems between buildings can provide excellent capacity at reasonable prices.

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CABLING

What To Do?

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PHILOSOPHY

- Curriculum drives the Technology, therefore it drives cable requirements. You should not choose your cable until you've chosen the technologies (and associated budget) you will utilize.
- The contractor responsible for making a technology operate should be responsible for installing that technology's cable.

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CABLE TYPES

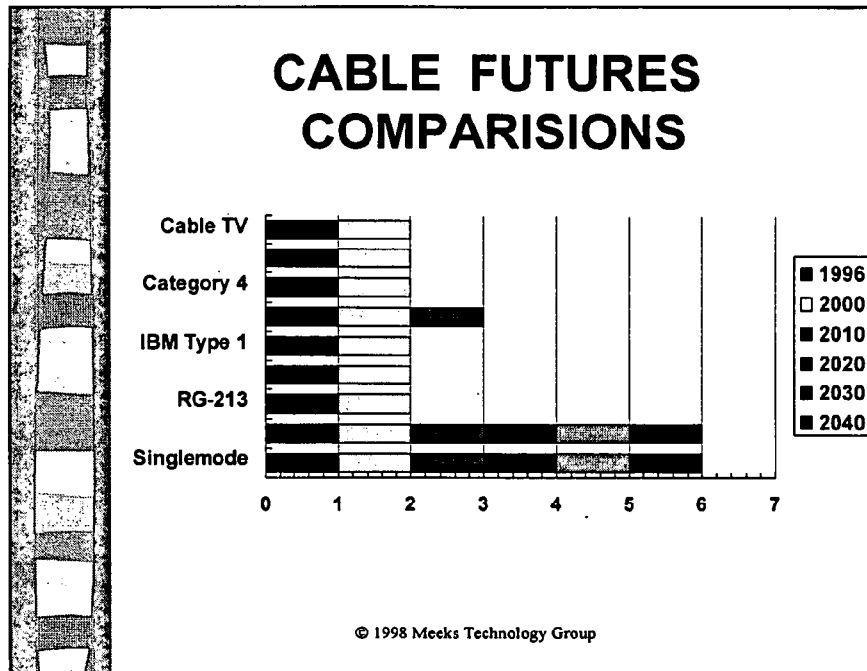
	MHz	Mbps	Distance	Network
Category 1	.15	NA	Obsolete NA	Voice Only
Category 2	1	1	Obsolete 100m	Baseband
Category 3	16	10	100m	Ethernet
Category 4	20	16	100m	Token Ring
Category 5	100	155	100m	All
IBM Type 1	20	16	100m	Token Ring
RG-58 Coax	16	10	185m	Ethernet
RG-213	16	10	500m	Ethernet
Cable TV	300	.056 to 10	400m	NA

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FIBER OPTIC CABLE

	MHz	Mbps	Distance	Source
Multimode	600	1Gbs+?	5km	LED
Singlemode	1400	3Gbs+?	50km	Laser

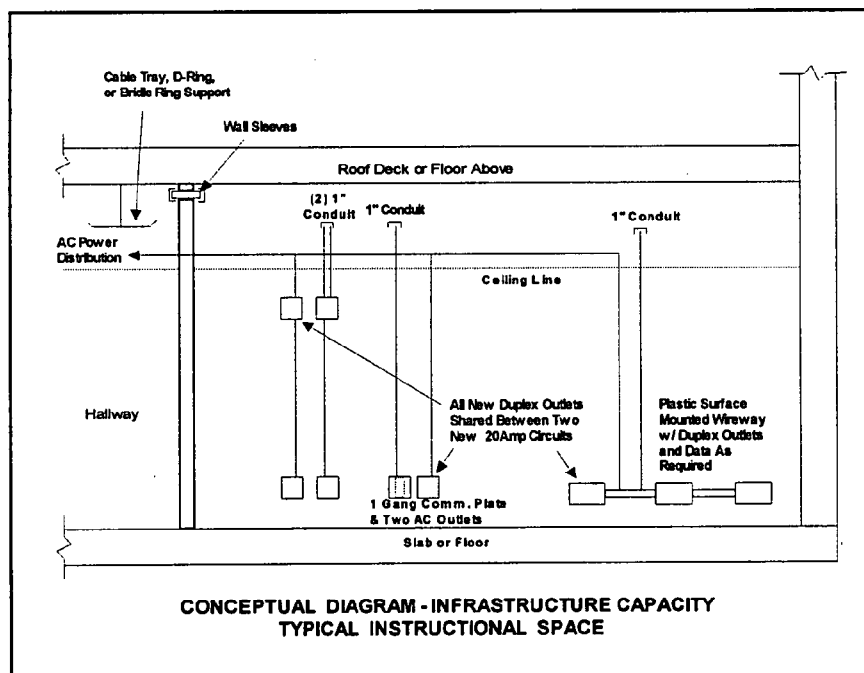
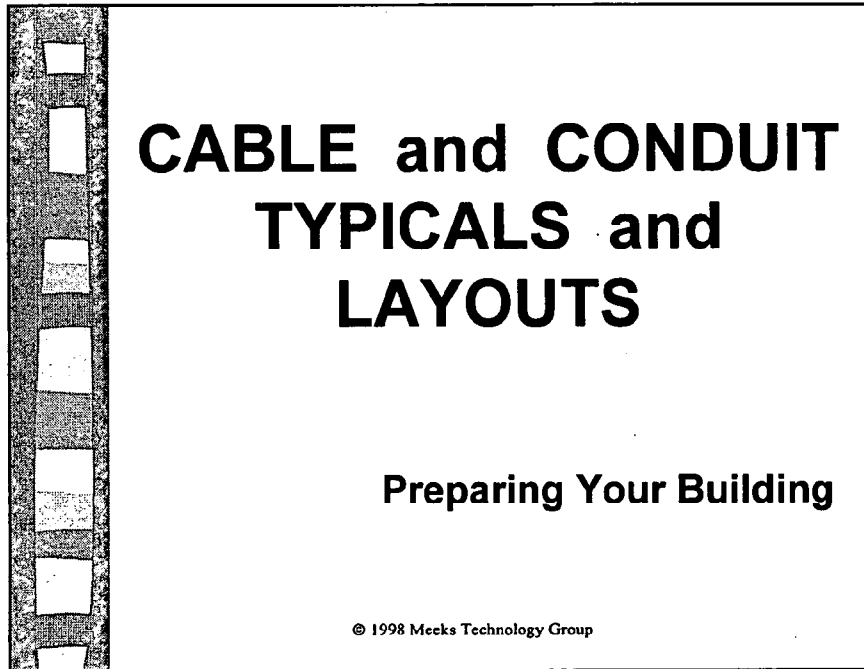
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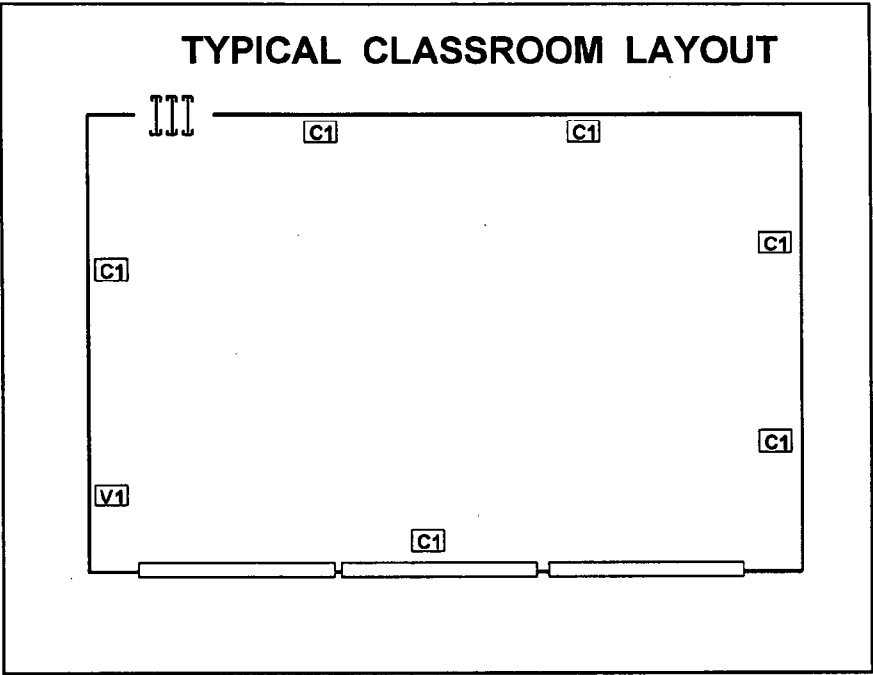


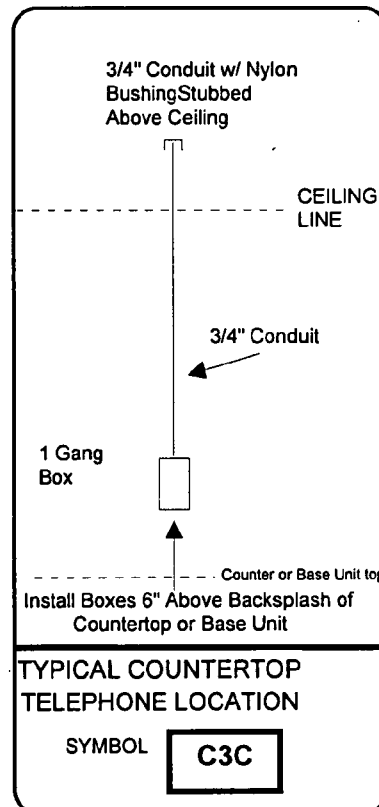
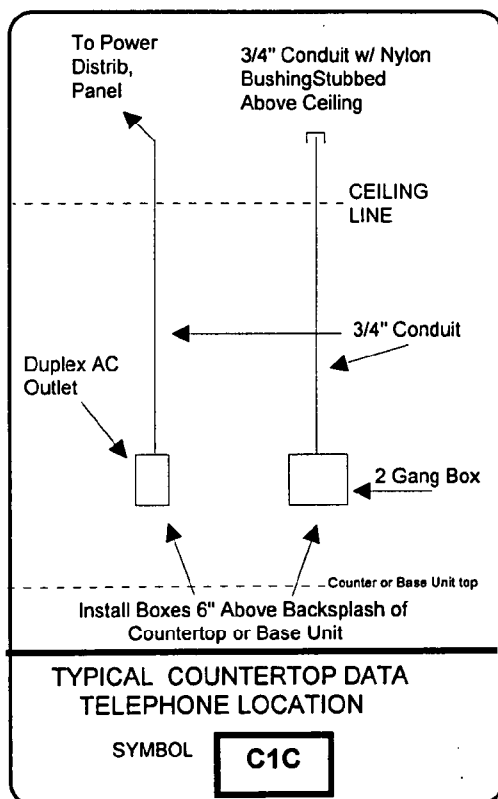
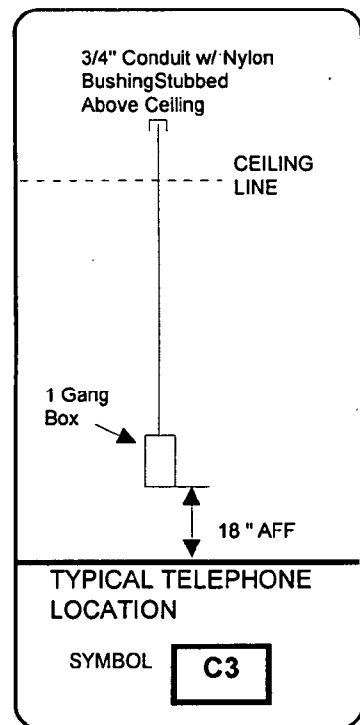
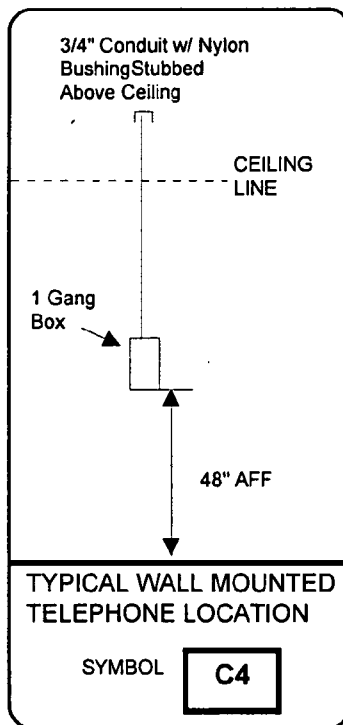
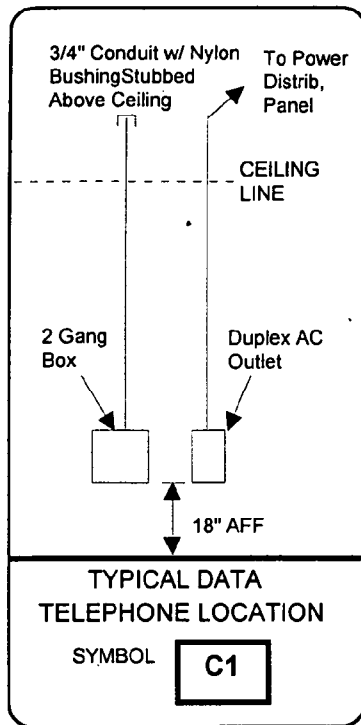
FUTURE PROOFING YOUR BUILDING

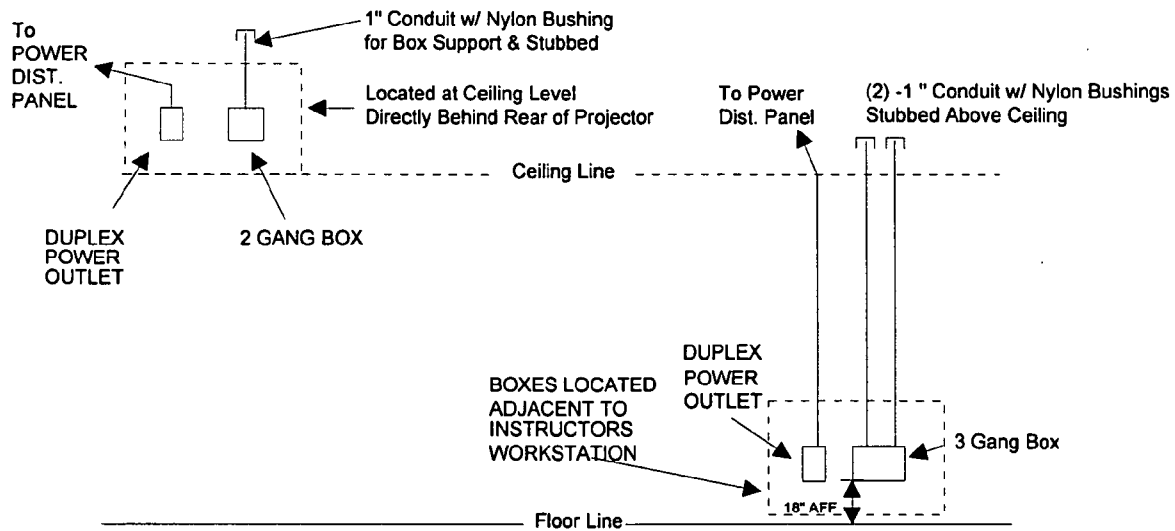
- Category 5 UTP (copper) For Data
- Category 5 UTP (copper) For Voice
- RG-6 Coax for Cable TV Distribution
- Four Strands of Fiber (Tight Buffer)

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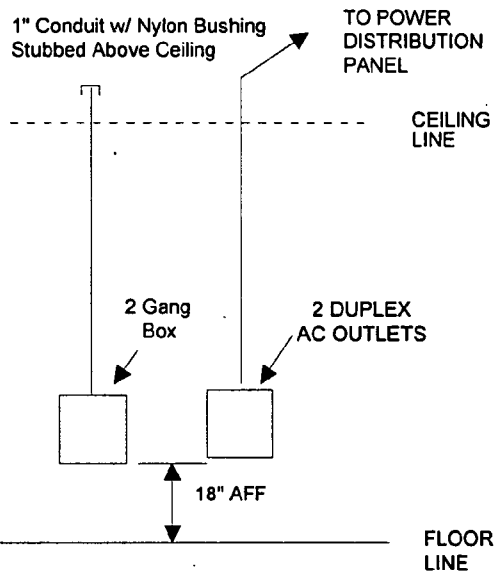




TYPICAL CEILING VIDEO PROJECTOR LOCATION

SYMBOL

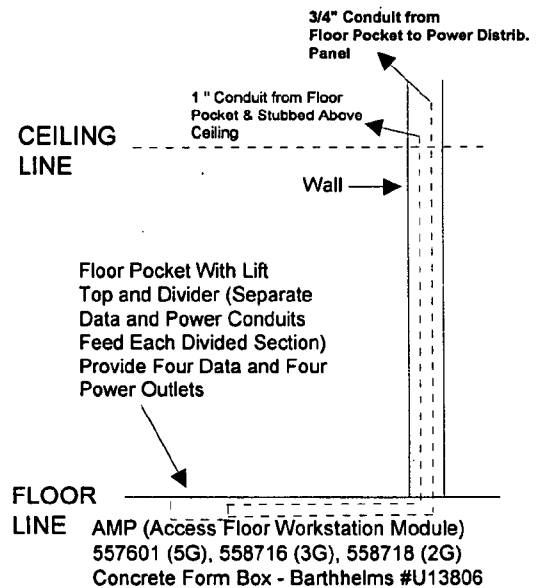
CVP



TYPICAL DATA LOCATION

SYMBOL

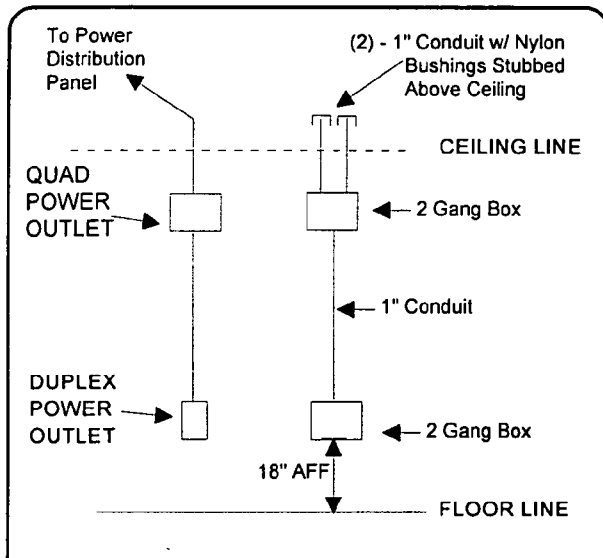
C2



TYPICAL FLOOR POCKET DATA LOCATION

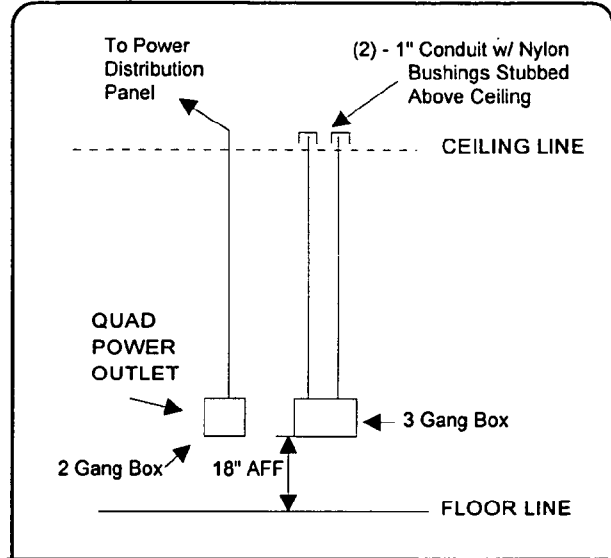
SYMBOL

FP



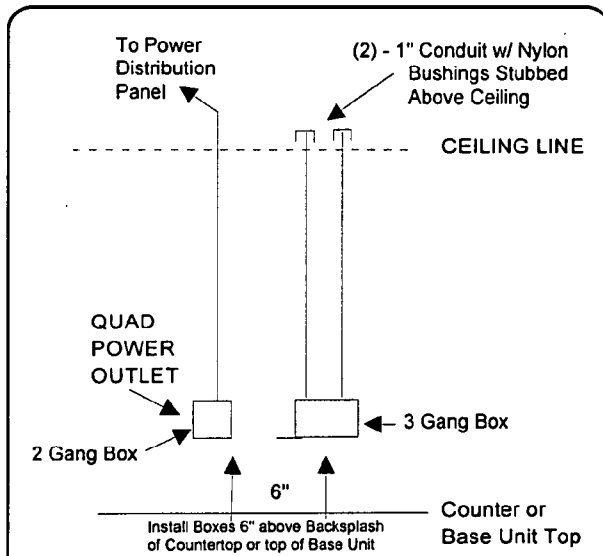
TYPICAL VIDEO LOCATION

Symbol **V1**



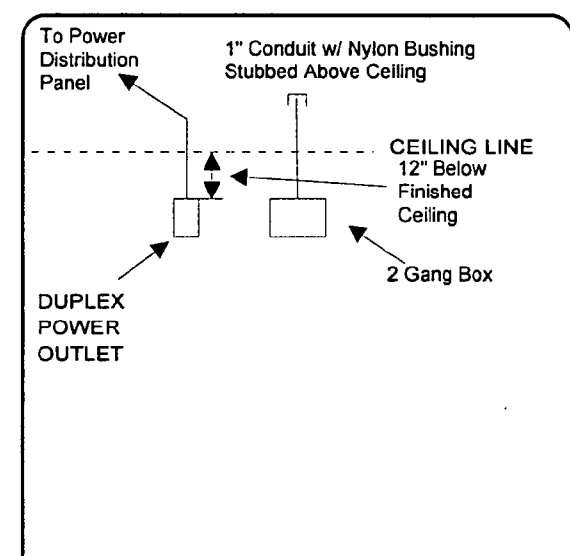
TYPICAL VIDEO PORT LOCATION

Symbol **VP**



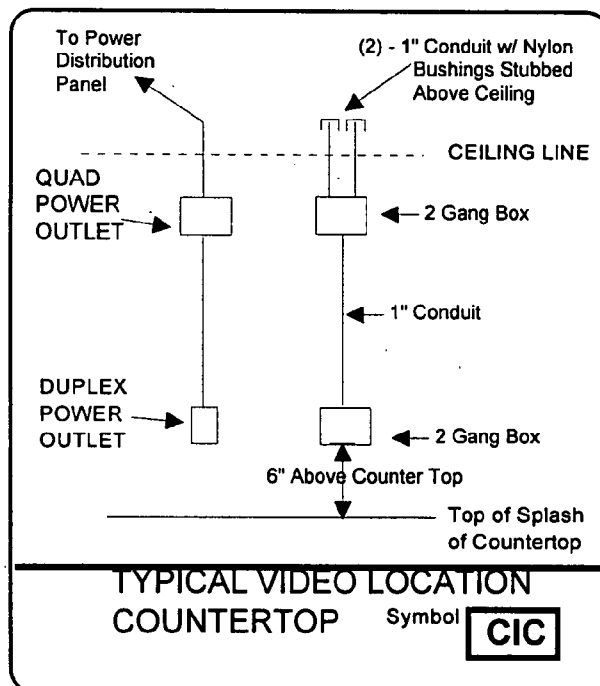
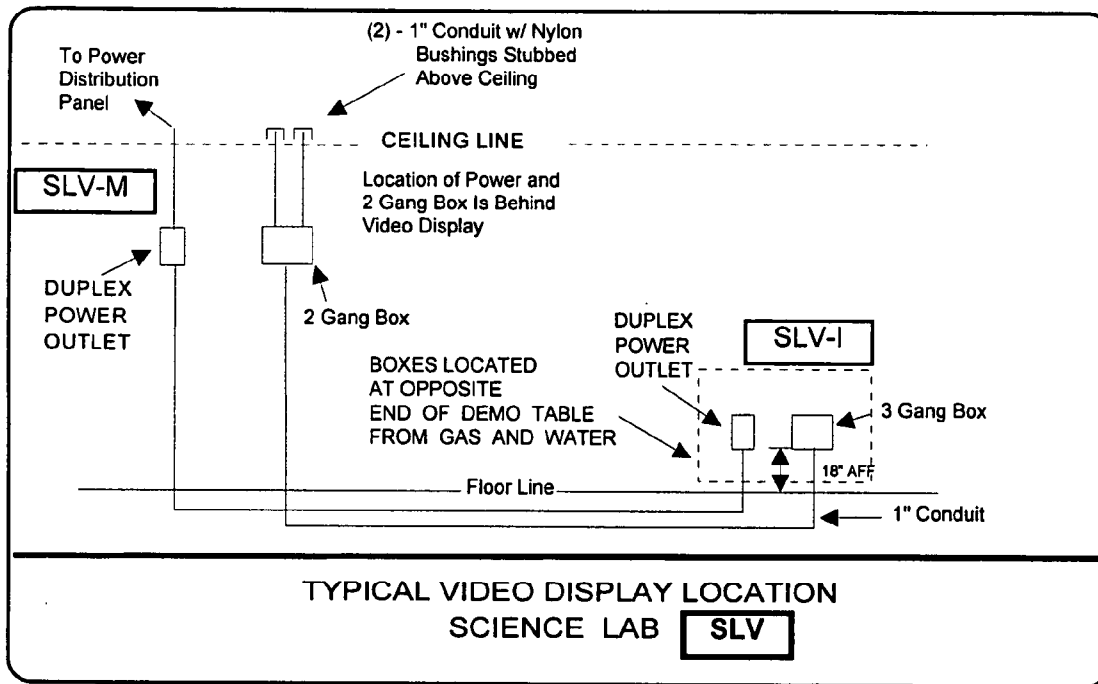
TYPICAL DESKTOP VIDEO LOCATION

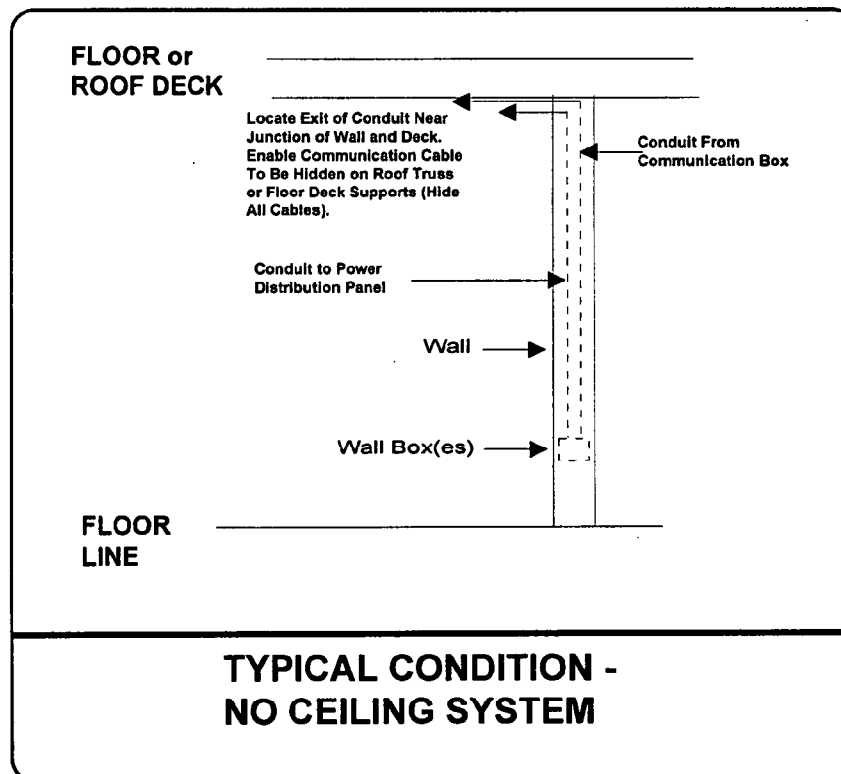
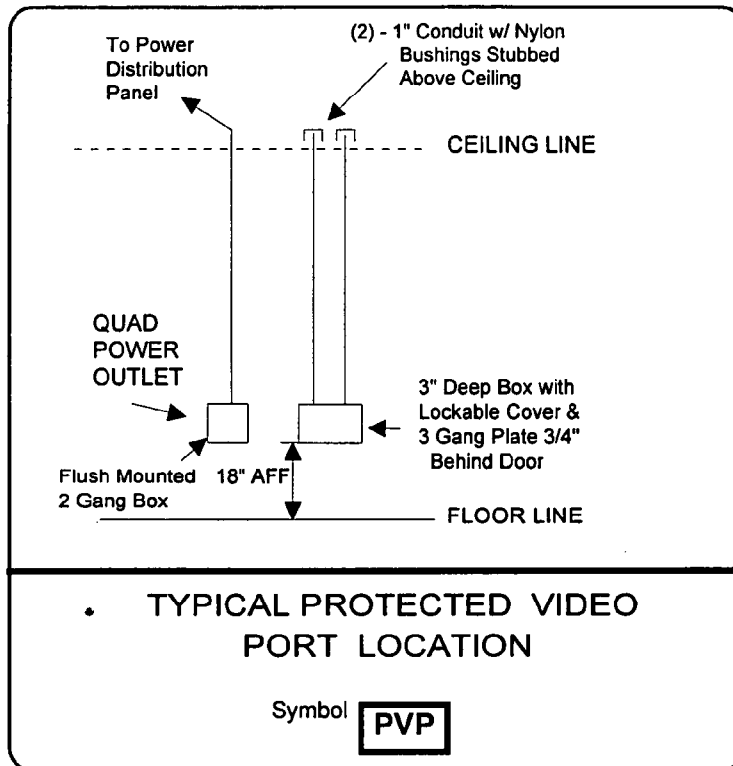
Symbol **VPC**



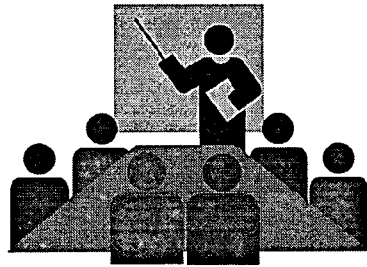
TYPICAL VIDEO DISPLAY LOCATION

Symbol **VD**



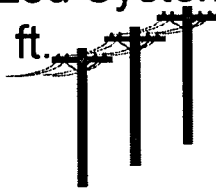


IMPLEMENTATION COSTS FOR EDUCATIONAL TECHNOLOGY SYSTEMS



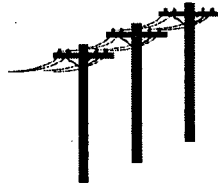
MACRO BUDGET COSTS

- ♦ Per Student Basis - \$1500 to \$2000
- ♦ Square Footage Basis
 - Basic Systems @ \$3 to \$5/sq. ft.
 - Maximized Systems @ \$7 to \$10/sq. ft.



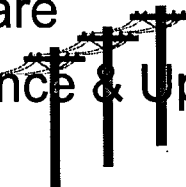
MACRO BUDGET COSTS

- ◆ Instructional Stations Basis
 - Voice, Video, Data w/1 Computer and Printer \$10,000 per room
 - With 6 Computers, \$25,000 per space



BASE LINE CATEGORIES

- ◆ Infrastructure Cost
- ◆ Systems
- ◆ Staff Development
- ◆ Staff Support
- ◆ Courseware
- ◆ Maintenance & Upgrades



BASE LINE CATEGORIES

♦Infrastructure Cost

- New Construction - \$1500 per classroom equivalent
- Renovation/Modernization - \$1500 per classroom equivalent



BASE LINE CATEGORIES

♦Data Systems Cost

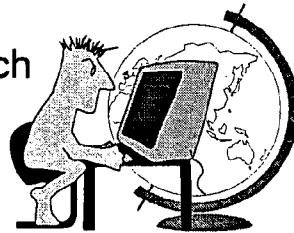
- Simple Ethernet Network - \$350 per port
- Distributed Ethernet Network - \$450 per port
- Collapsed Backbone Ethernet Network
 - ♦\$450 per primary port
 - ♦\$225 per secondary port



BASE LINE CATEGORIES

♦Computers

- Teacher Workstations - \$2500 each
- Student Workstations - \$1900 each
- Multi-Media/Reference Stations - \$2800
- Fileservers - \$10,000 each
- Software - 10%
- Production Systems



BASE LINE CATEGORIES

♦Video System Cost

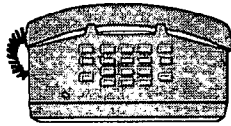
- Video Display w/installation - \$1000 per location
- Video Distribution - \$750 per location
- Media Retrieval - \$2750 per location
- Video Content - 10%



BASE LINE CATEGORIES

◆Voice System Cost

- Public Address Systems - \$150 per speaker
- PBX Phone System - \$500 per line
- Voice Mail Systems - \$8K, 12K, 16K

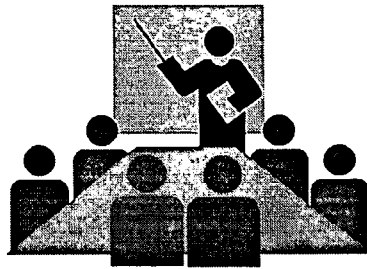


Determining Types and Quantities of Spaces



TYPES OF SPACES

◆Instructional Space



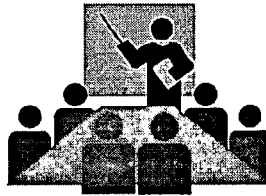
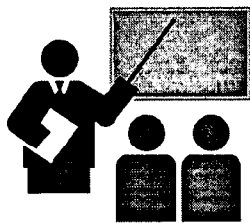
TYPES OF SPACES

◆Computer Lab



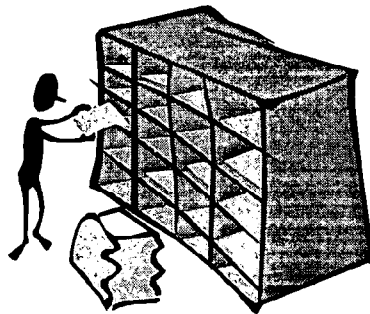
TYPES OF SPACES

◆Flex Space



TYPES OF SPACES

◆Media Center



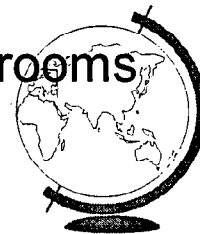
TYPES OF SPACES

◆Office



QUANTITY OF SPACES

- ◆1 Classroom = 1 Classroom
- ◆1 Computer Lab = 2 Classrooms
- ◆3 Flex Spaces = 1 Classroom
- ◆6 Offices = 1 Classroom
- ◆1 Media Center = 2 Classrooms



ISSUETRAK

A CEFPI Brief on Educational Facility Issues

Topic : Implementation Costs for Educational Technology Systems

Issue Trackers: Glenn E. Meeks REFP, Ricki Fisher and Warren Loveless

Date Filed: December 1997

CEFPI BRIEF

Personnel involved in planning or developing schools have cost estimating tools which enable them to determine construction macro-budgets from simplified data structures. Unfortunately, they do not have similar tools that enable them to determine educational technology costs for those same projects. The following is an overview of the process and general costs used in estimating educational technology systems on a macro-budget basis. Facility planners, architects, and school facility personnel can use this process to determine budgets during the bond planning, preliminary project planning and schematic stages of facility projects.

Based on data from more than thirty projects, we have developed simple cost estimates for technology systems based on a per-port system. Obviously, these costs will vary based on the region of the country you are in and the competency level and quantity of technology contractors available to you. Costs and components for each system listed below are based on facilities in the Midwest with an average of 35 instructional spaces. Please note – as buildings become smaller, the per port price increases.

BASE LINE COST CATEGORIES AND PRICES

Infrastructure

<i>New Construction</i> \$1,500 for each classroom equivalent	One additional 20-Amp 110VAC circuit— Six empty data box drops & six duplex outlets.
<i>Renovation/Modernization</i> \$3,000 for each classroom equivalent	One new 20-Amp 110VAC circuit— Six empty data box drops & six duplex outlets, surface mounted. NOTE: For additional electrical service to building, add minimum \$50,000.

Data Systems

<i>Simple Ethernet Network</i> (One head end) \$350 per port.	Includes head end port, patch cord and patch panel, Category 5 copper cable to user port including connectors and labor, jumper cable from wall to computer, and computer set-up.
<i>Distributed Ethernet Network</i> (Head end with remote closets) \$450 per port.	Includes head end equipment and fiber port, six strand fiber cable to remote cabinet locations including connectors and labor. Also includes remote data closet location with remote head end port, patch cord and patch panel, Category 5 copper cable to use port including connectors and labor, jumper cable from wall to computer or printer, and set up of printer or computer.
<i>Collapsed Backbone Ethernet Network</i> (Head end with hub in every classroom) \$450 for first port (primary) in room; \$225 per port (secondary) thereafter.	Includes head end equipment and fiber port for each room, four strand fiber cable to each classroom, connectors and labor for installation, and a small (6 or 8 port) dumb hub in each room. Category 5 copper cable is run from the hub in the room to each data port location required.

Computers

<i>Teacher Workstations</i> \$2,500 each.	Medium high end computer (150 MHz), includes Network Interface Card @ \$100 and printer allowance of \$400.
<i>Student Workstations</i> \$1,900 each.	Lower end computers (100 MHz), includes Network Interface Card @ \$100 and printer allowance of \$200.
<i>Multi-Media/Reference Stations</i> \$2,800 each	High end performance computer with sound board, speakers (headsets), multi-speed CD-ROM drive.
<i>Fileservers</i> \$10,000 each	Provide one fileserver for every 50 computers.
<i>Computer Content</i> 10%	Determine total value of computer purchases and add 10% for software content purchases. (Special content—administrative and library software packages are additional costs.)
<i>Production Systems</i>	Video and computer components for students and staff to generate content. Minimum of: \$15K/elementary school; \$25K/middle school; \$40K/high school.

Video System

Video Display with Installation \$1,000 per location.	Includes a 31" display installed with monitor mount and local inputs down low for use with movable video equipment
Video Distribution \$750 per location.	Includes a coaxial cable TV distribution system throughout facility and one steerable C/Ku satellite antenna with receiver/tuner.
Media Retrieval \$2,750 per location.	Includes the head end equipment and source for a media retrieval system.
Video Content	Take 10% of the total video budget and set aside for purchase of video content which is intended for use on the video system.

Voice Systems

Public Address Systems \$150 per speaker.	Includes master clock, tone generator, zonal interface, PBX interface, and power amplifier at head end. Additionally, the cable running to the speaker and speaker with back box or surface mounted box are included.
PBX Phone System \$500 per line.	Includes PBX switch port, cabling to phone, connectors and labor, and phone instrument. Include four lines for voice mail and the lines coming to the building.
Voice Mail Systems	Add as follows: \$8K/elementary school; \$12K/middle school; \$16K/high school.

Professional Development

	Determine your total budget and set aside 5-10% of it for professional development costs associated with the installation of educational technology systems.
--	--

DETERMINING QUANTITIES OF EACH TYPE OF TECHNOLOGY CATEGORY

A feel for the quantity and types of space required is determined during the preliminary stages of project design. These spaces can be divided into the following five types of spaces.

- **Instructional Space** — These spaces are defined as any location where student instruction will take place 80% of the school day. For example, classrooms and science labs would be considered instructional spaces. NOTE: Media centers, which contain instruction areas, are considered instructional spaces with extra computers and offices.
- **Computer Lab** — Defined as any space with a large concentration of computers where the primary instructional functions are delivered via one computer for every student. These may include smaller project labs (8-12 computers) and larger computer labs (20-35 computer stations).
- **Flex Space** — This is a location where instruction utilizes the space for less than 80% of the instructional day but still requires some type of technology support of the instruction program delivered. Typically, these areas include a cafeteria, gymnasium, conference room and/or auditorium.
- **Media Center** — Typically, media centers contain multiple implementations of technology. Where applicable, portions of a media center may be considered classrooms, computer labs, or offices. Additionally, these center will have computers related to a library automation system and multi-media stations available for research and remote data access functions.
- **Office** — An office is any smaller location which is not typically utilized for instructional functions yet the person occupying the space needs access to a phone and a data port for a computer. The space can be an office, a cubicle, or simply a desk. Personnel (and therefore their spaces) whom we categorize as requiring office space would be administrators, secretaries, counselors, nurses, teacher offices, and custodians.

Based on the instructional or administrative needs of the facility, a simple technology program description must be developed for each type of space. The program description should outline the specific technology planned for the space, [i.e., the Instruction Space will have one teacher computer with a printer, two student computers with one printer (yielding five data ports), a telephone, a video display and output from a video distribution system with media retrieval capacity, and a public address speaker.] Additionally, will you need to upgrade the infrastructure in an existing building or add infrastructure to the scope of a new building?

From the Types of Spaces count and the Technology Program Description of each space, you then can create a matrix which lists the number of ports or components in each space. A subsequent matrix should multiply the number of components times the quantity of each space and then total the ports and components of the same nature. Once you have determined the number of each type of port or component, add 10% spares to the quantity and sum.

DETERMINING EDUCATIONAL TECHNOLOGY BUDGET

• Infrastructure

To arrive at a total cost of infrastructure, you must determine the number of classroom equivalents. Using a classroom as the base, the cost of all other types of space is calculated as a portion of, or as an increase to a typical classroom. The ratios used are as follows:

Classroom: 1=1

Computer Lab: 1=2

Flex Space: 3=1

Office: 6=1

Media Center: 1=2

Once your classroom equivalents have been determined, multiply them times the new construction or renovation cost to determine your infrastructure budget.

• Systems

To determine your Educational Technology Systems costs, use the total sum of each type of technology port or component, then simply multiply the quantity times the port or component costs. For the computers and video, add in your content and production costs. For the phone, add in your voice-mail costs. Add 5-10% for professional development costs, and 5% of the total as a contingency budget.

By utilizing this macro-budgeting process, you should be able to arrive at an Educational Technology Systems budget that can be used throughout the planning process.

EDUCATIONAL TECHNOLOGY BUDGET WORKSHEET

PROJECT: New Construction or Renovation

ROOM TOTALS

ROOM TYPE	Quantity	Video Display	Video Distribution	Media Retrieval	Phone	Primary Data port	Secondary Data port	Teacher Workstation	Student Workstation	MultiMedia Workstation	Infrastructure
Instr Spaces											
Computer Lab											
Flex Spaces											
Media Center											
Office											
TOTAL											

Infrastructure: Total Rooms x Infra Cost = Total _____ x _____ = _____

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Video: Total Displays x Per Unit Cost = Subtotal _____ x _____ = _____
 Total Distrib x Per Unit Cost = Subtotal _____ x _____ = _____
 Total Media Retrieval x Per Unit Cost = Subtotal _____ x _____ = _____
 TOTAL _____ = _____

Voice: Total Phones x Per Unit Cost = Total _____ x _____ = _____
 Phones Cost Per School _____ = _____
 Voice Mail _____ = _____
 Public Address Total Speakers x Per Unit Cost = Total _____ x _____ = _____

Totals: Infrastructure = _____
 Data = _____
 Computers = _____
 Video = _____
 Phones = _____
 TECHNOLOGY TOTAL _____ = _____

 Software (10%) = _____
 Video Content (10%) = _____
 Staff Development (5% - 10%) = _____
 Contingency (5%) = _____
 OTHER TOTAL _____ = _____

PROJECT TOTAL _____ = _____

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CEFPI wishes to thank Glenn E. Meeks REFP, Ricki Fisher and Warren Loveless of the Meeks Technology Group, headquartered in Cary, North Carolina, for their invaluable time and expertise in preparing this brief.

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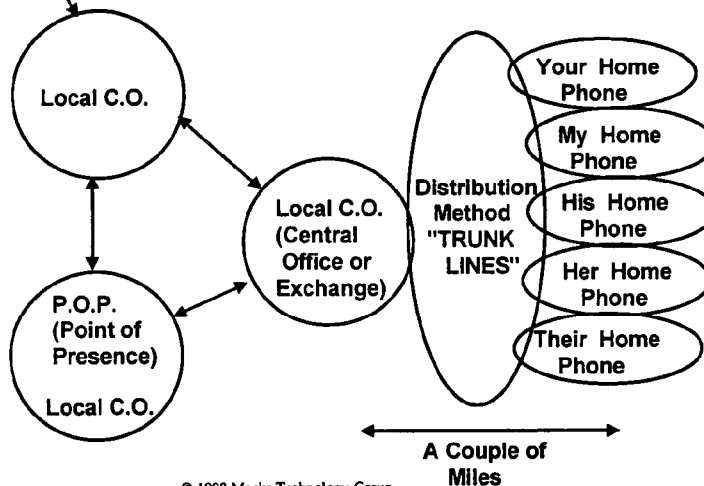
VOICE NETWORKS

Basic Concepts and
System Types

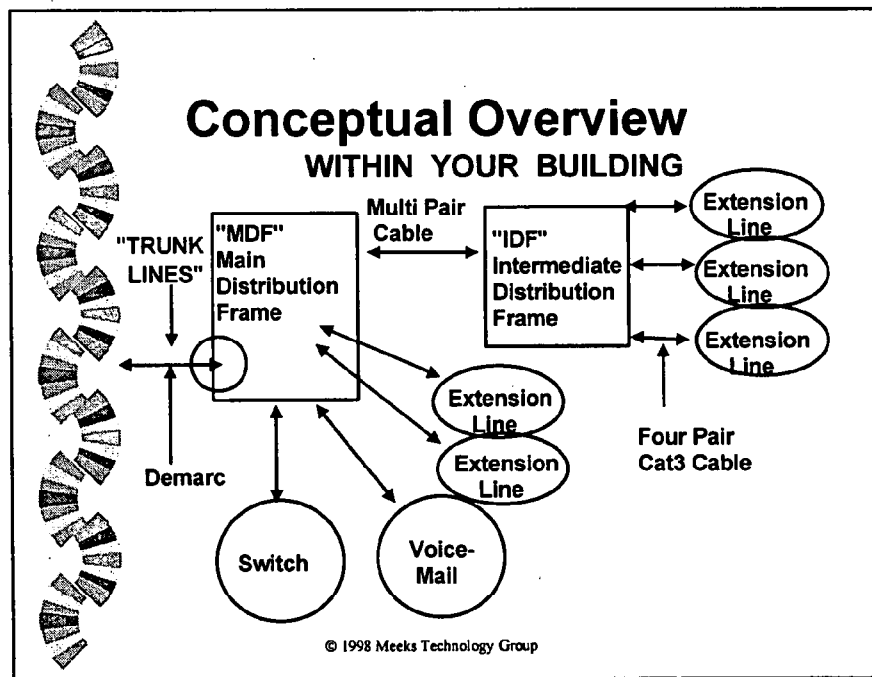
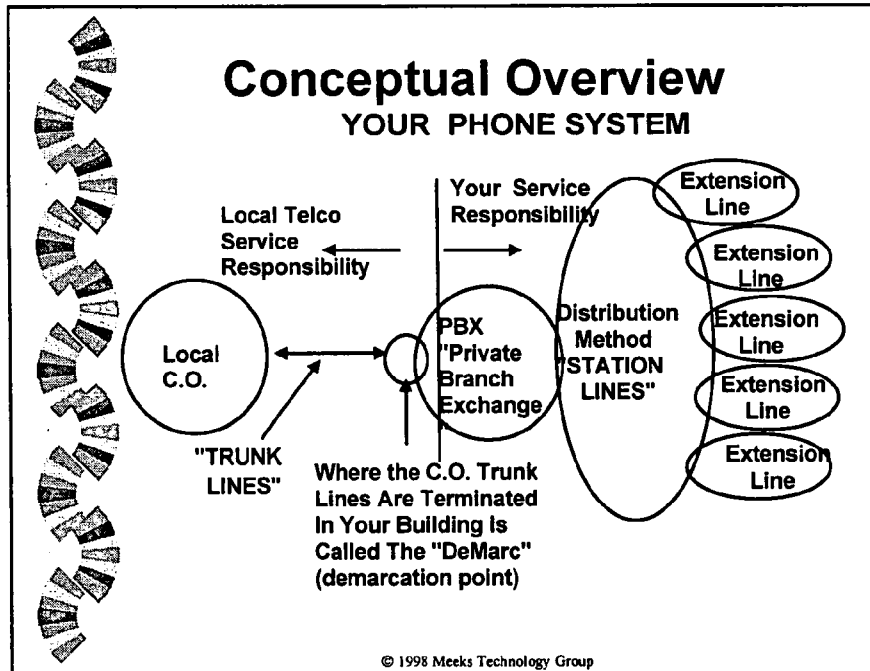
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AT&T
MCI
SPRINT
etc...



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TYPES OF PHONE INSTRUMENTS

- Single Line Analog
- Multi-Line Analog
- Single Line Electronic
- Multi-Line Electronic
- Digital

*** All Phone Types Are Available
As Speakerphones**

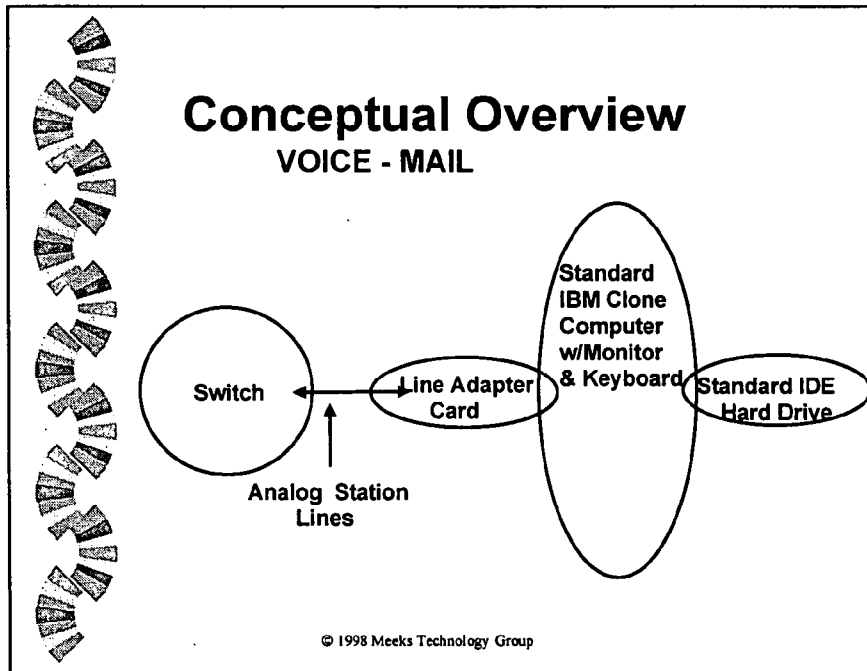
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TYPES OF SYSTEMS

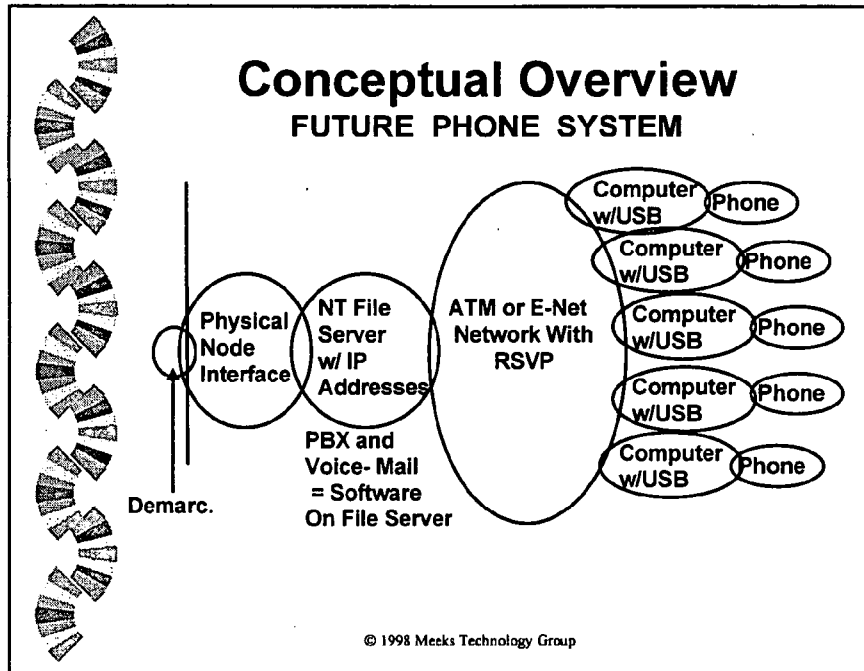
- KEY Systems
- HYBRID
- PBX (Full Blown)

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VOICE-MAIL SYSTEMS

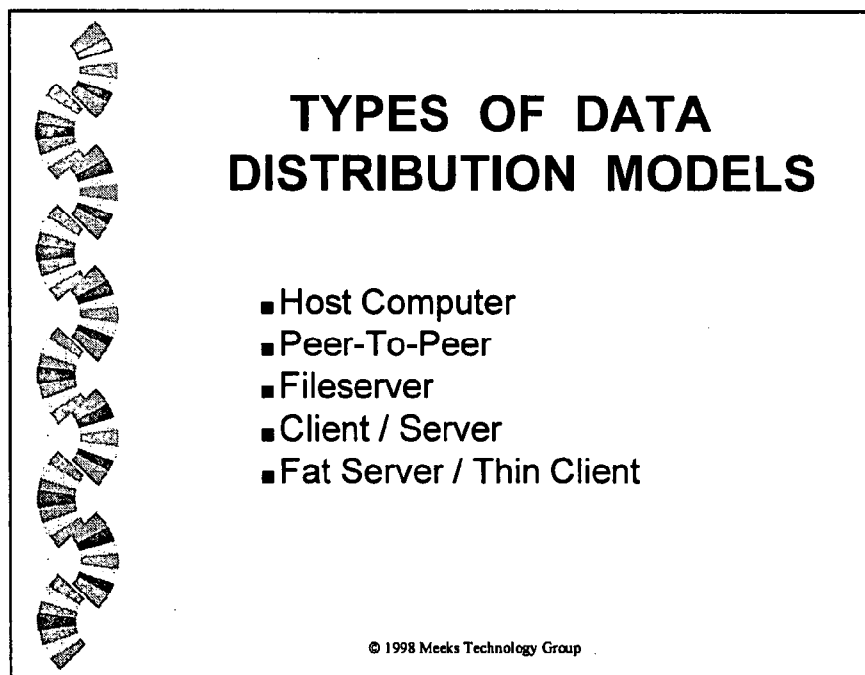
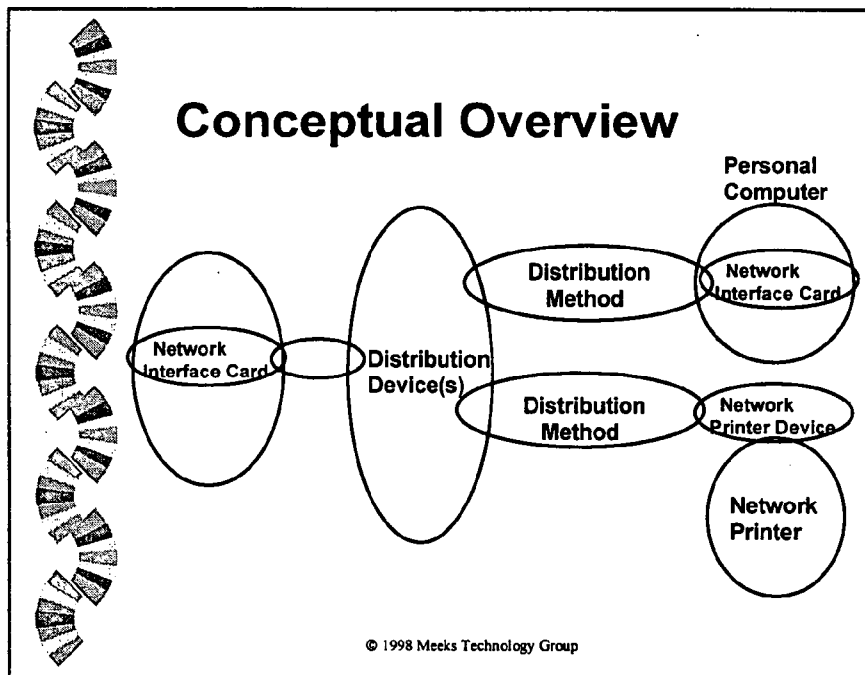
- All Systems Are Microprocessor/Software/ Hard Disk Based.
- Standalone (No Phone Switch - \$8K)
- Simple Analog System - 400 Mailboxes / 6 Hours Of Recording Time (\$12K to \$15K).
- Medium Level Analog - 800 Mailboxes with 18 Hours of Record Time (\$20K to \$24K)
- "Dial Out" Software Costs More.
- Digital Voice-Mail (\$25K and Up)
- If All Phone Switches Are The Same, A District Wide System Can Be Implemented

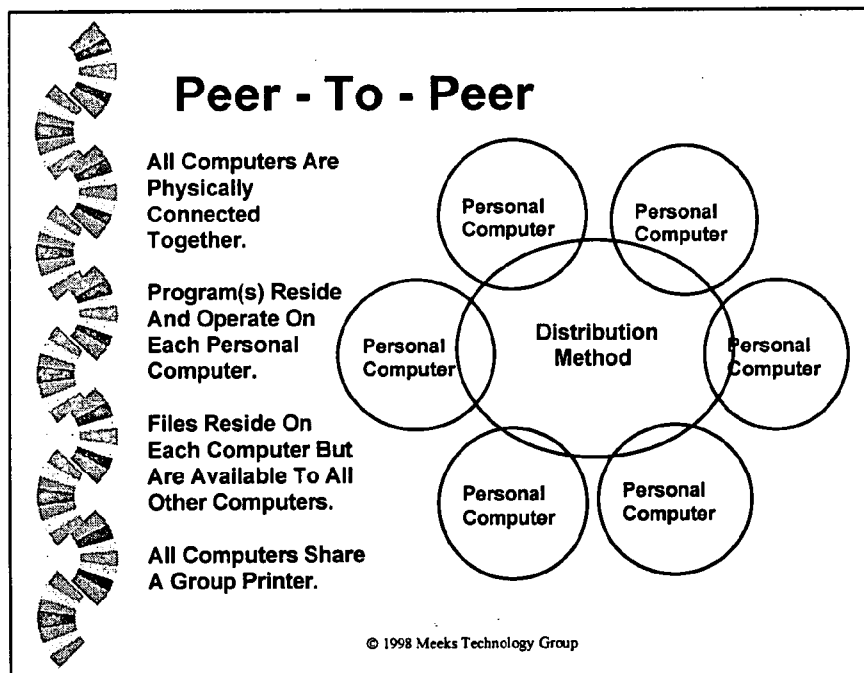
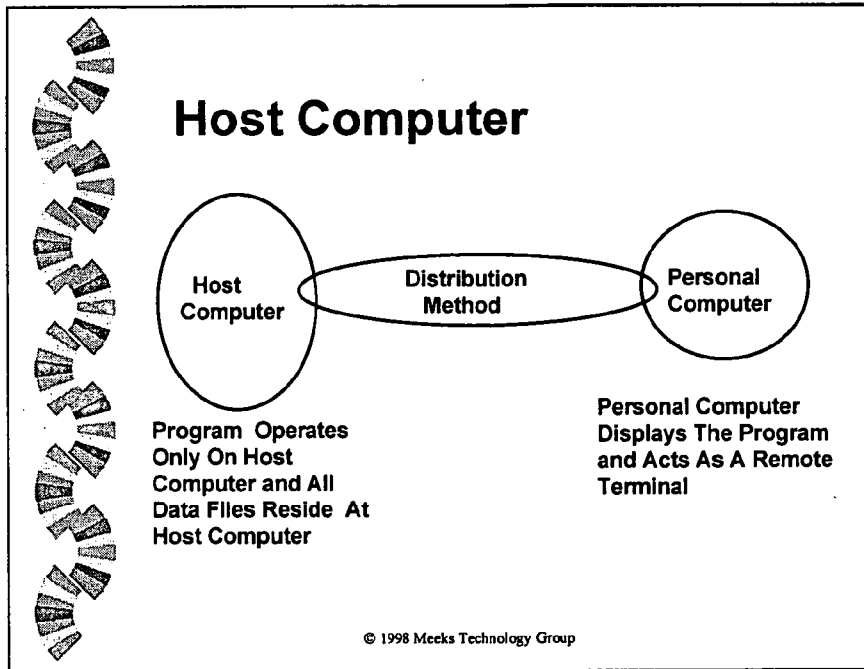


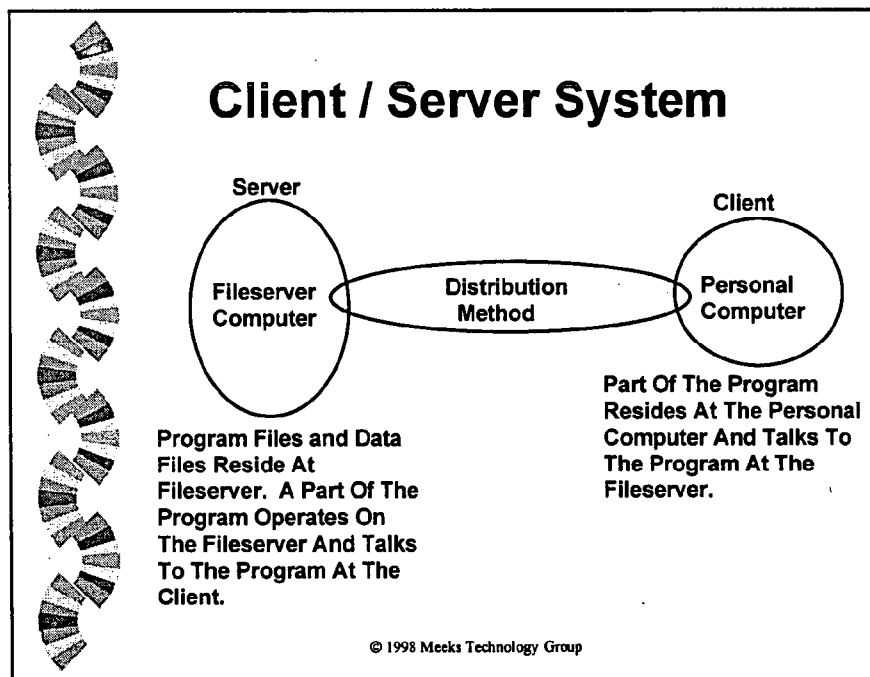
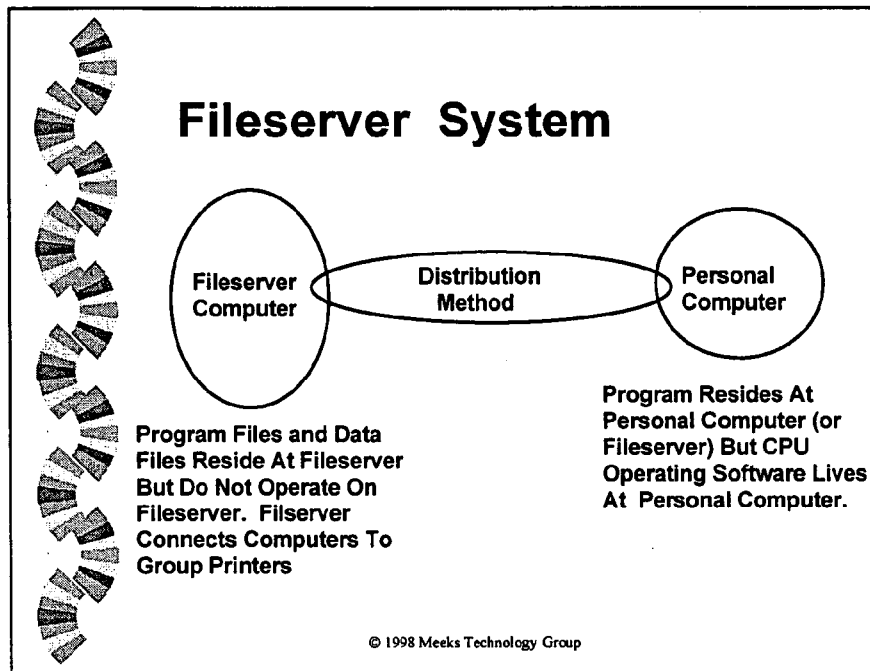
DATA NETWORKS

Basic Concepts and
System Types

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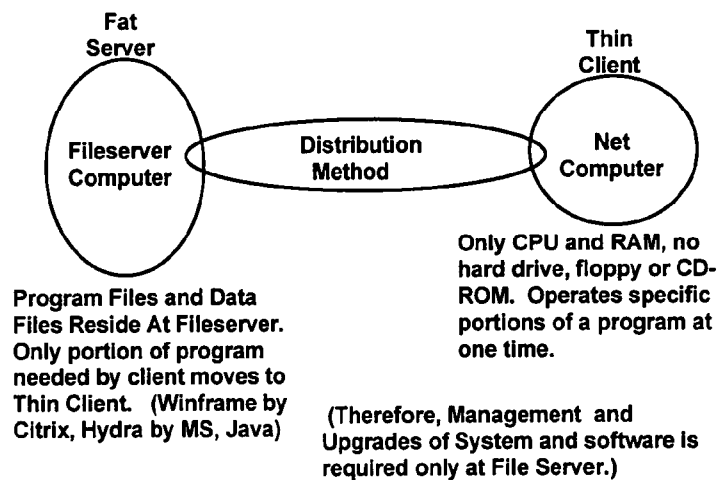








Fat Server / Thin Client System



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ETHERNET RULES OF THUMB

- Thinnet Coax (One Coax = One Segment)
 - 600 Feet (Including Cables to Computers)
 - Maximum 29 Computers Per Segment
- Twisted Pair - Maximum 330 Feet Including Cable to Computer.
- Maximum Number of Segments Between Two Computers.
 - Three Segments With Other Computers
 - Plus Two Segments Without Computers.
- Maximum of 1024 Computers.
- To Increase System Speed, Segment Network With E-Net Switch.

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TOKEN RING RULES OF THUMB

- IBM Type 1 Cable @ 16Mbps
 - 495' With 132 Stations
- Category 5 UTP @ 16Mbps (Note 1)
 - 594' With 132 Stations
- Category 5 STP @ 16Mbps
 - 990' With 132 Stations
- Star Topology (MAU, CAU, LAU) 330'
- Rings are Connected Through Fileserver
- Rings Operating At Different Speeds Require Use Of A Bridge
- Increase Network Speed, Segment Rings and Add Token Ring Switch.

Note 1: IBM Requires Media Filters

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DATA NETWORK CAPACITY

- Interactive Mode Maximum = 10%
- Batch Mode Maximum = 30%
- Transmits Data in Varying Sized "Packets"
Each Packet Has It's Origination & Destination Address
Packets Range From 64 bit to 4096 bit
Impossible To Predict How Data Will Be "Packeted".
- Video With More Than 10fps (Frames Per Second), The Audio and Video Do Not Synchronize With Each Other
- Unless System has RSVP or Similar Protocol Capacity.
- Future Proofing = Each Device Is On Its Own Dedicated Switch Segment.

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**Switched or Shared Ethernet Or
Token Ring Networks Cannot
Transmit "Full Motion" - "Full
Screen" Video Without Special
Equipment AND Limiting The
Number of Users OR Use of RSVP
Protocol.**

**However, "ATM" Networks (Asynchronous
Transmission Method) Does Not Exhibit
These Limitations But Are VERY EXPENSIVE**

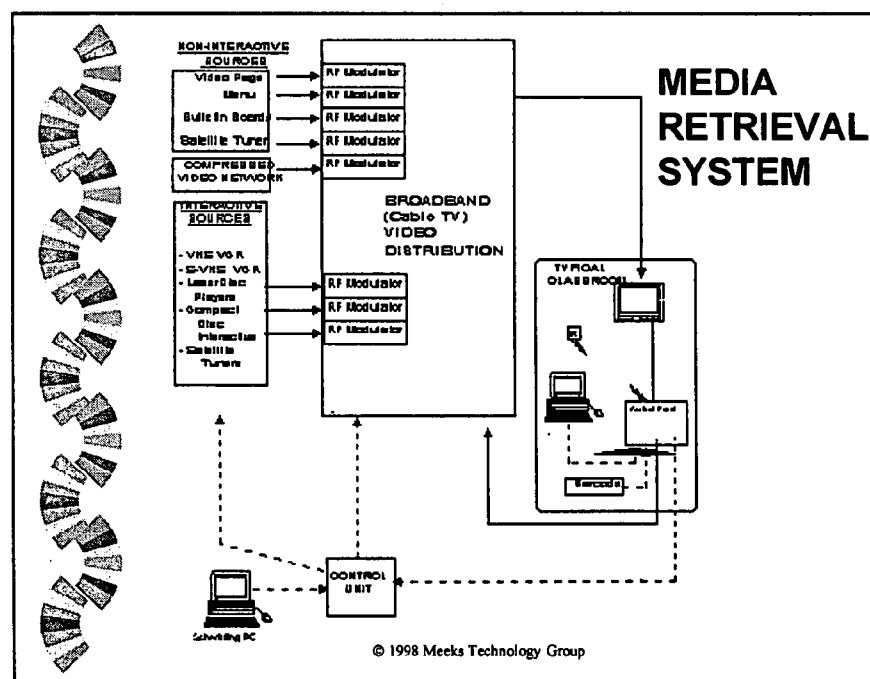
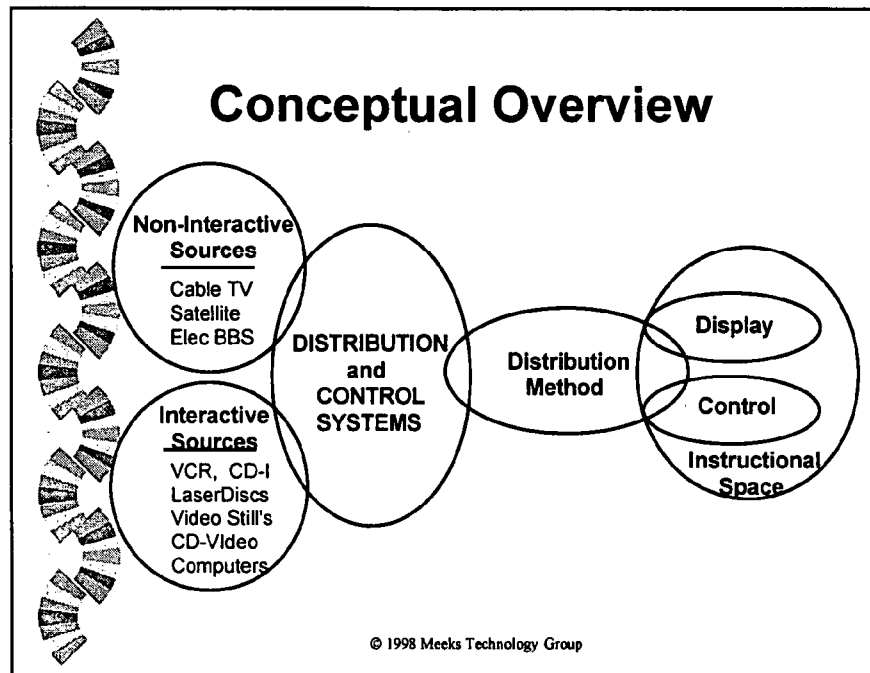
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MEDIA RETRIEVAL SYSTEMS

**Basic Concepts and
System Types**

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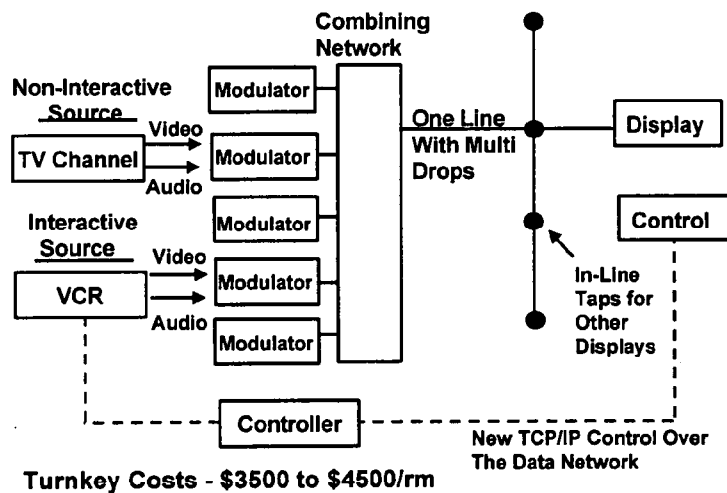


TYPES OF SYSTEMS

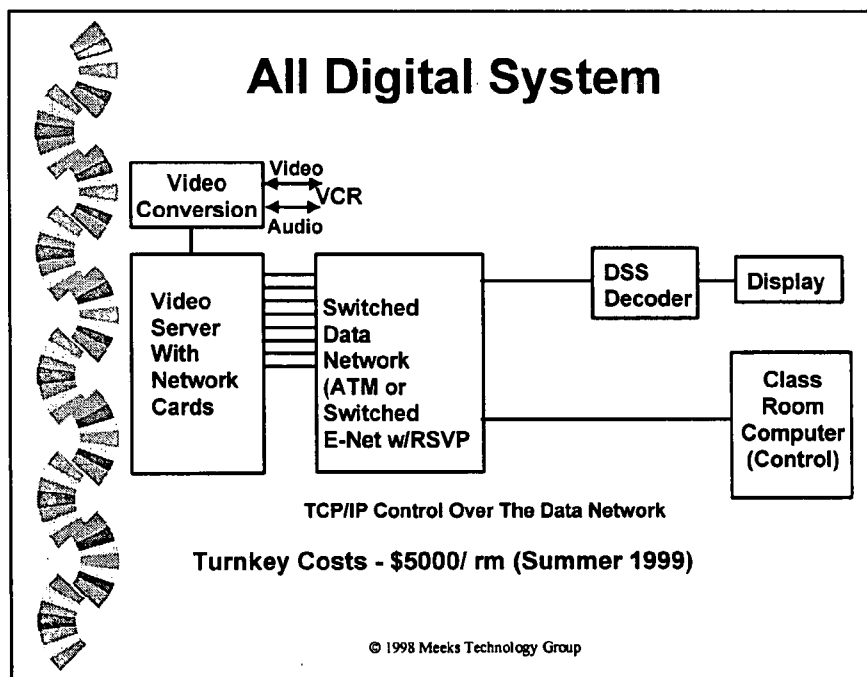
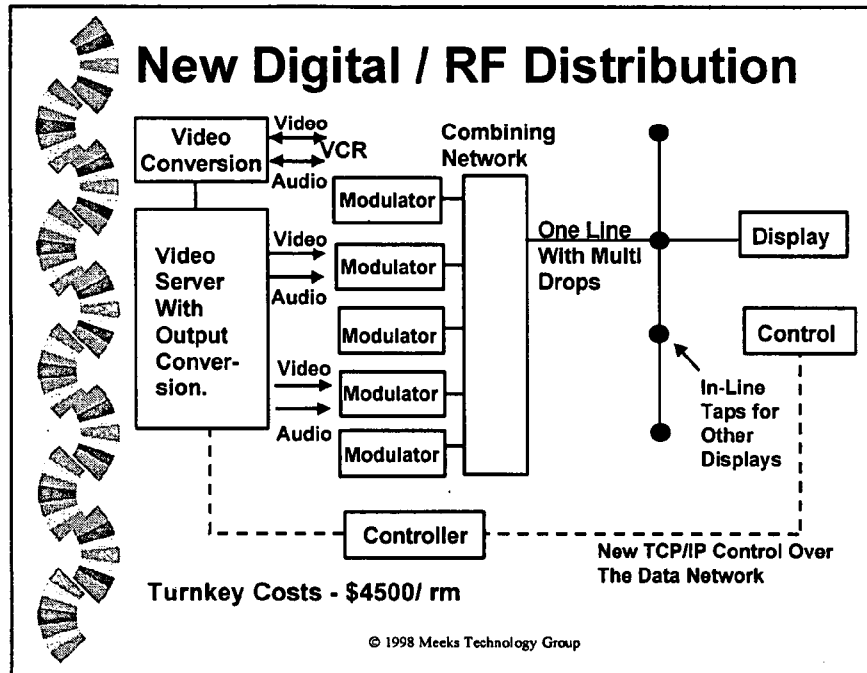
- Cable TV
(Also called RF "Radio Frequency " System or Broadband System)
- Shielded Twisted Pair
- Baseband Coax (Baseband Copper)
- Baseband Fiber
- Digital Source / RF Distribution
- Total Digital

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Cable TV (RF or Broadband)



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VIDEO STANDARDS

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STANDARD VIDEO (CCIR-601) (What We Use At Home)

- Defined By the National Television Standards Committee (NTSC)
- Provides 30 Pictures (Frames) Per Second (Divided into odd and even lines - fields)
- Capable of 525 Lines of Resolution (LOR) (Cable TV and VCR's provide 220 LOR) (RF Tuner on TV sets is limited to 220 LOR)

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HIGH DEFINITION TELEVISION

(What We Will Be Using At Home)

- New Digital Video Disc (DVD) New CD-ROM & Video Format - Up To 17GB of Storage.
- Grand Alliance Has Finalized Specification for TV Sets, Compression, On-Air, Cable (ATV)
- Digital Format - 30 Pictures per Second and 1125 Lines of Resolution.
- Full Signal Is Not Compatible With Current Cable TV systems, Requires Redesign and Component Replacement.
- Signal Is Compatible With New DSS Satellite

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VIDEO / DIGITAL TRANSMISSION

(Transmission Capacities)

- NTSC Video Requires: 140Mbps
Or 6Mbps With Compression
- Acceptable Video w/Compression:
1.5Mbps MPEG - (DSS Satellite)
- HDTV Video Requires: 680Mbps
With Compression MPEG2 - 8-22Mbps
- Therefore, What Capacity Do I Need To
My Computer Desktop? 10Mb Duplex
(20Mbps Dedicated)

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SCREEN SIZE ISSUES

- NTSC Is "4Wide by 3 High" - Typical of The Box This Text Appears In.
- HDTV Will Change Screen Ratios To "16 Wide by 9High" A Ratio Similar To Movie Theater Screens.
- "Quicktime" Is 1/8 to 1/4 NTSC Screen Size And At Fewer Frames Per Second.

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VIEWING DISTANCE STANDARDS

- Standard Television
1" of Diagonal = 1' of Viewing Distance
- Projection Screens (Film & Video)
Screen Width = 1/6 of Max Viewing Distance
- Computer (Similar Resolution to Film)
Screen = 1/6 of Max Viewing Distance

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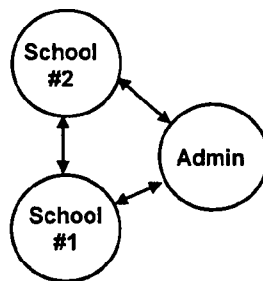
WIDE AREA NETWORKS

Overview and Basic Services

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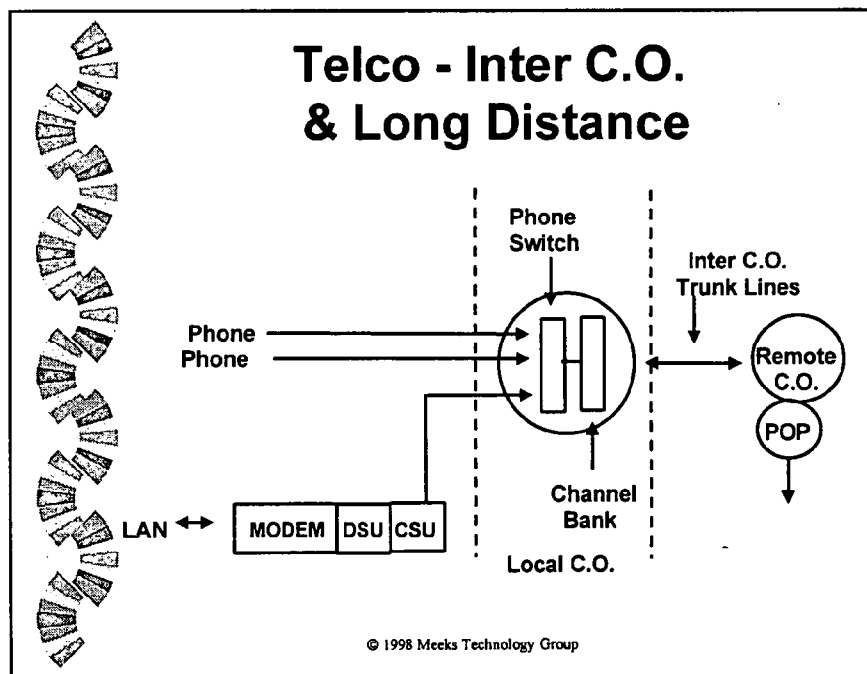
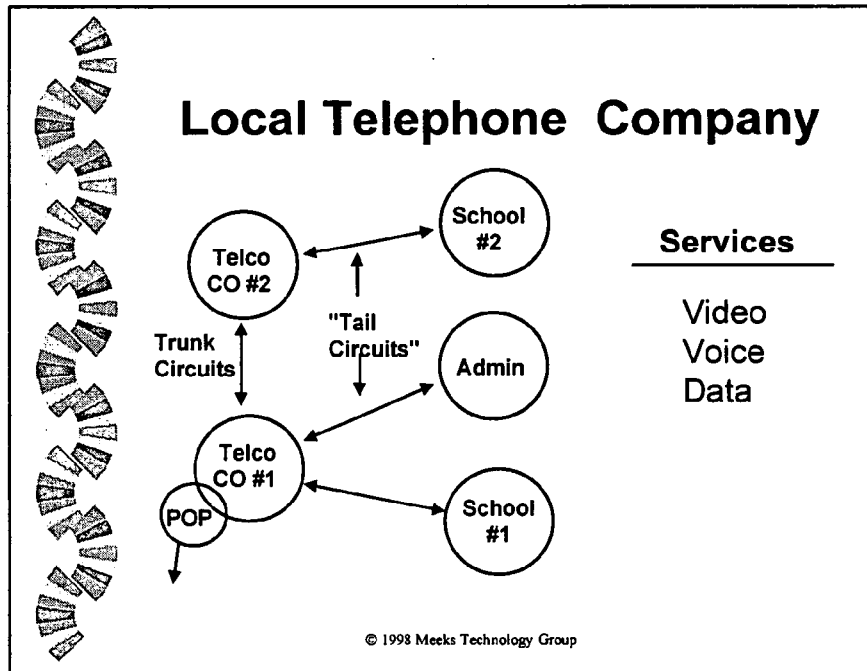
Conceptual Overview



How Can I Connect ?

Local Telephone Co.
Local Cable TV Co.
Microwave System
By-Pass Networks
ITFS
Satellite

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LOCAL TELCO SERVICES

■ DEDICATED CIRCUITS:

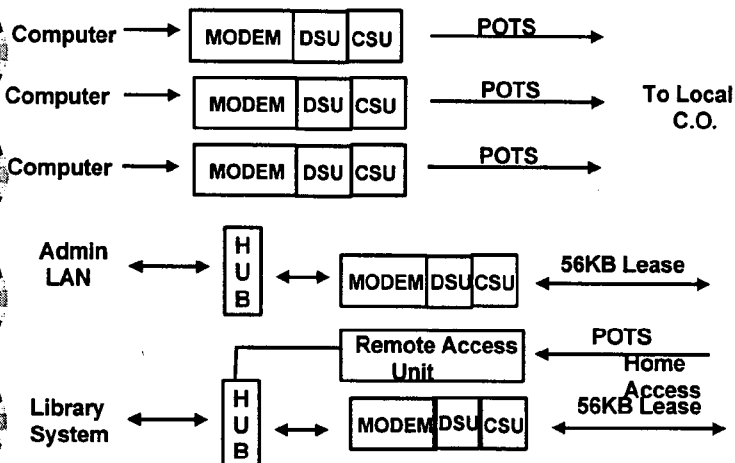
- 56KB Leased Lines
- T-1 Leased Lines (1.54Mbps)
- Frame Relay (56KBps - 2Mbps)
- Other Dedicated Tail Circuits (1.54 to 800Mbps)

■ SWITCHED CIRCUITS

- POTS (Plain Old Telephone Service) 28Kbps
- ISDN (Integrated Services Digital Network)
Basic Rate (128Kbps), Primary Rate (1.54Mbps)
- ATM (Asynchronous Transfer Mode) 155Mbps

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Traditional School Connection



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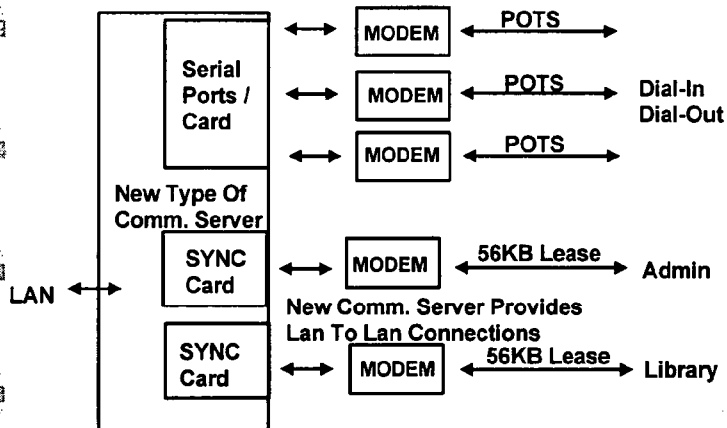
New Communication Servers All In One Box

- Multi-Protocol Router for LAN-to-LAN Connections.
- Bandwidth On Demand Capacity.
- Interchangeable Async. or Sync Cards.
- Dial-In and Dial-Out Capability.
- Resource of Building LAN(Available To Any Computer On The LAN).
- Multi-Level Security.
- Log Of All External Access Activity.

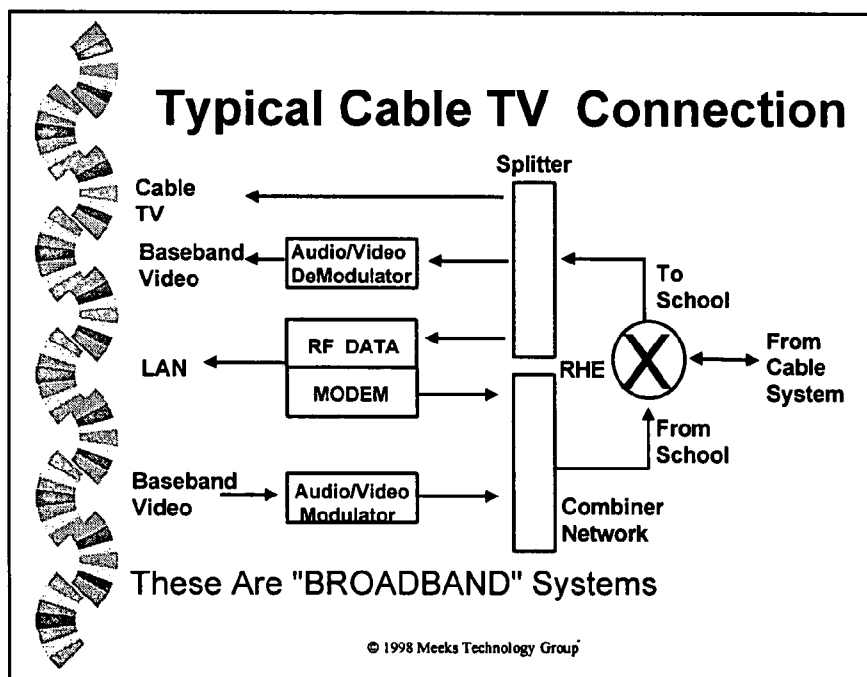
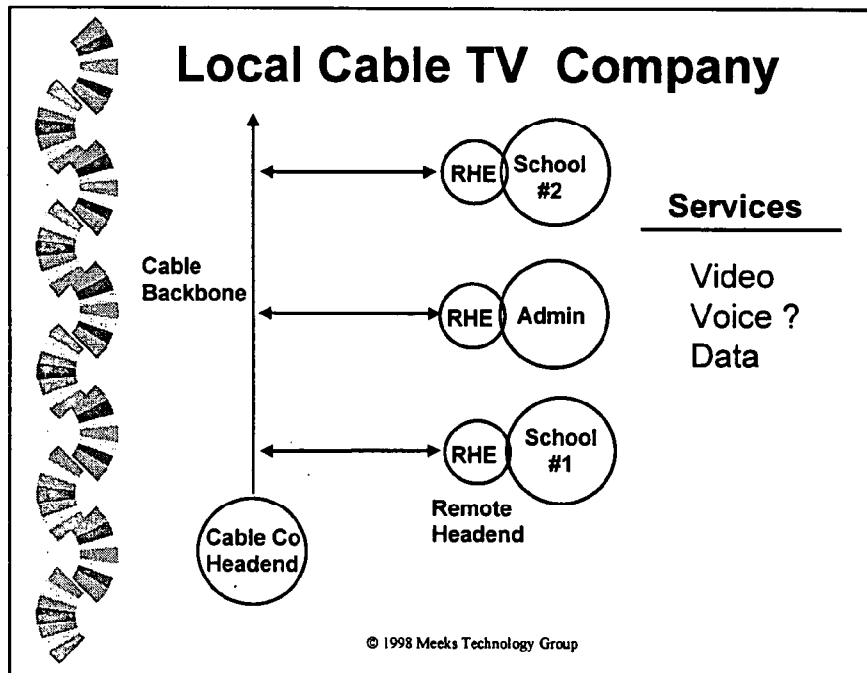
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New School Connections



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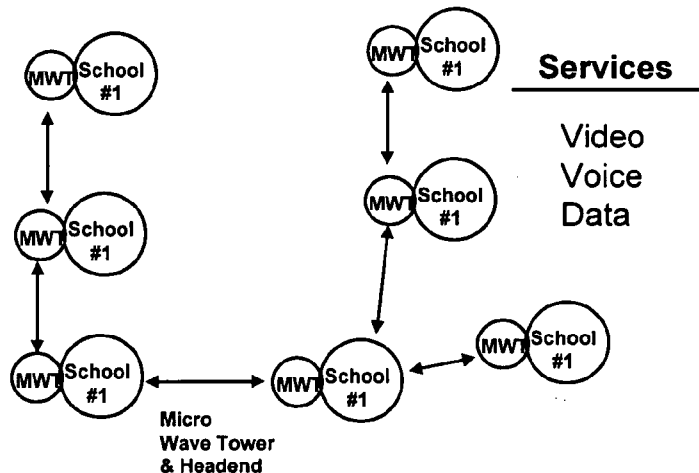
CABLE TV ISSUES

- Limited Number Of Channels Available.
 - Typical System 5 In by 50 or 60 Out.
 - Maximum 28 In By 28 Out
 - One Channel (One Pair In Each Direction)
 - = One 10Mbps Ethernet
 - = One Video Signal
- Not Economical For Voice Circuits
- As Franchise Requirement - Cable Company Provides A Dedicated School Broadband Network?

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Microwave Systems



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MICROWAVE ISSUES

- Limited Capacity - One Channel = 12MHz Each Channel Of Transmission Requires Another Radio.
- Expensive Equipment - Bi-Directional Radio, Antenna (Dish), Tower, and Installation for :
 - One Duplex Video Circuit
 - One 10Mbps Ethernet
 - 24 Channels of Voice\$60,000 per Location.
- Requires FFC License and Path Analysis
- Daisy- Chain Links. Lose One Radio And All Other Locations Downstream Are Down.

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LOW POWER RADIO

- New Technology Which Provides 2.5 Mile Radio Frequency Based Connection (915MHz and 2.4GHz).
- Average Connection is 4 Mbps.
- Maximum Speed is 10 Mbps.
- Works Well for Data (i.e. Internet)
- Slow Connection For Full Motion Compressed Video Connections.
- Low Entry Costs (Less Than \$5,000 / Unit) and No Long Term Circuit Charges.

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BY-PASS NETWORKS

- Duplicates Telco Capacities Without Going Through The Telco Facilities.
- Privately Owned and Operated.
- Few Locations Around Country And Those Are Only In Metropolitan Areas.
- Typically Less Expensive Than Telco Circuits.
- Equipment Required Is By Lease Only and Pay Monthly Circuit Charges.

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ITFS NETWORKS

- ITFS (Instructional Television Fixed System)
- On-Air (Using Standard TV Channels) Reception By Any TV Receiver.
- Typically Limited Number of Channels.
- One-Way Non-Interactive. Program Cannot Be Controlled By User And Occurs On A Pre- Scheduled Basis.

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SATELLITE NETWORKS

- No Distance Or Location Limitations.
- Extremely Expensive Technology:
 - Video Uplink/Downlink (\$180K and Up)
 - Transponder Time \$1000/Hour
- Prohibitive Costs Limit The Number of Active Channels.
- Channels Bouncing Off Of Different Satellites Require Separate Uplink/Downlink.
- Downlinks (TVRO - Television Reception Only) Are Relatively Inexpensive But Are One-Way / Non-Interactive.

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TECHNOLOGY BID PACKAGES

Controlling The Process

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TECHNOLOGY and BID ISSUES (Changes)

- ◆ Division of Work
- ◆ Project Timelines
- ◆ Actual Bid Process

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TRADITIONAL SCOPE OF WORK

OWNER

GENERAL CONTRACTOR

ELECTRICAL

- General Communications
- Specialty Audio Systems
- Life Safety System
- Security Systems

OWNER DIRECT

Individual Contractors

- Phone Systems
- Data Networks
- Satellite Receivers & Dishes
- Other Specialty Systems

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REVISED SCOPE OF WORK

OWNER

GENERAL CONTRACTOR

ELECTRICAL

- Life Safety System
- Security Systems

TECH. CONTRACTORS

- Voice Network
- Video Network
- Data Network
- General Communications
- Specialty Audio Systems

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WHY REVISE SCOPE OF WORK?

- ◆ **COST SAVINGS**

Technology represents 5% to 10% of total building cost, therefore markups can be large dollar items.

- ◆ **PRIMES CANNOT SUPPORT TECHNOLOGY**

Electrical prime does not understand the technology.

- ◆ **DIRECT ACCESS TO TECH. CONTRACTOR**

Owner/CM/ GC needs direct access to and interface with the contractor responsible for the technology.

- ◆ **EQUAL FOOTING WITH OTHER PRIMES**

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ONE TECHNOLOGY PRIME?

- ◆ **SINGLE POINT OF SITE COORDINATION**

- ◆ **SINGLE POINT OF SCHEDULE COORDINATION**

- ◆ **SINGLE POINT OF MAINTENANCE**

Negative

- ◆ **SINGLE PRIME IS MORE EXPENSIVE THAN MULTIPLE TECHNOLOGY PRIMES**
(Prohibitive where contractors have no prior experience for combined bids.)

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MULTIPLE TECHNOLOGY PRIMES?

- ◆ **CREATES GREATEST COMPETITION AMONG BIDDERS (Lowest Cost).**
- ◆ **MAINTAINS CONTRACTOR EXPERTISE IN THEIR RESPECTIVE AREA.**

Negative

- ◆ **SITE and SCHEDULE COORDINATION**
- ◆ **MAINTENANCE / WARRANTY ISSUES**

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PROJECT TIMELINES

Technology Affects Project Timelines



THREE DISTINCT BID PACKAGES

- ◆ **INFRASTRUCTURE**
- ◆ **TECHNOLOGY SYSTEMS and CABLING**
- ◆ **COURSEWARE and LOOSE EQUIPMENT**

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INFRASTRUCTURE

- ◆ **AC Power**
- ◆ **HVAC Needs**
- ◆ **Raceways and Conduit**

Part of the Architectural/Engineering Process
Bids as Part of The General Trades

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TECHNOLOGY SYSTEMS and CABLING

- ◆Voice Network and Cabling
- ◆Video Network and Cabling
- ◆Data Network and Cabling
- ◆Audio Systems and Cabling

Defined by an Owners' "Vision/Application"
Process. Bids as a Distinct Package.

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TECHNOLOGY SYSTEMS and CABLING TIMELINE

- ◆Should Bid No Earlier Than Twelve Months No
Later Than Six Months Prior To Implementation
Use.

Provides As Close to Current Technology As Possible

Elementary Schools - Bid w/ General Trades

Middle Schools - Bid Separately and Later

High Schools - Bid Separately and Later

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COURSEWARE and LOOSE EQUIPMENT

- ◆Computers and Printers
- ◆Computer Software
- ◆Audio/Visual Courseware
- ◆Computer Reference Sources (CD-ROM)
- ◆Library Automation System
- ◆Applied Technology Labs

Bid as separate packages by owner. Bid four months prior to implementation.

BID PROCESS

Packaging The Bid Proposals

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BID PACKAGE ISSUES

- ◆ **BID PROPOSAL FORMAT**
- ◆ **VENDOR and MANUFACTURER QUALIFICATIONS**
- ◆ **TOOLS FOR THE OWNER**

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BID PROPOSAL FORMAT

- ◆ **"REQUEST FOR PROPOSALS" Format**
- ◆ **"FUNCTIONAL" Specifications**
- ◆ **"PROPRIETARY" Specifications**

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REQUEST FOR PROPOSAL

- ◆ "Request for Proposals" describe a project in generic terms. It outlines basic system performance requirements and provides a listing of tasks the system must be capable of performing.

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POSITIVES

- ◆ Provides the Owner With Greatest Flexibility for Choosing Vendor.
- ◆ Provides for Greatest Vendor/Mfg Creativity for System Solutions
- ◆ Allows for More Voluntary Alternates and Value Engineering Proposals

NEGATIVES

- ◆ Apples and Oranges Comparisons
- ◆ May Not Be Legal in Your State

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FUNCTIONAL SPECIFICATIONS

- ◆ **Functional Specifications describe a project in thorough and complete detail from a quantity of components and tasks those components will accomplish. Does not detail the specific methodology of how a system performs a task.**

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POSITIVES

- ◆ **Provides "Apples to Apples" comparison.**
- ◆ **Provides Advance Knowledge of Specific System Configuration and Performance.**
- ◆ **Creates Competitive Bidding**
- ◆ **It Is Not Vendor/Manufacturer Specific**
- ◆ **Easy To Make Owner Driven Changes**

NEGATIVES

- ◆ **Owner Cannot Predetermine Vendor/Mfg**

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PROPRIETARY SPECIFICATIONS

- ◆ **Proprietary (or Performance) Specifications** describe a project in thorough and complete detail. Operational methodology is rigidly described, the performance parameters and quantities of each component within that methodology are rigidly described.

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POSITIVES

- ◆ **Provides "Apples to Apples" comparison.**
- ◆ **Provides Advance Knowledge of Specific System Configuration and Performance.**
- ◆ **Allows Owner to Pre-Select Vendor/Mfg**

NEGATIVES

- ◆ **Typically Vendor/Manufacturer Specific**
- ◆ **Inflexible System Configuration - Hard to Implement Owner Driven Changes**
- ◆ **Does Not Enhance Competitive Bidding**

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LEVELING THE PLAYING FIELD

Qualifying Vendors and Manufacturers

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VENDOR QUALIFICATIONS

(Submitted With Bid Proposals)

- ◆Three Years Prior Experience
- ◆Three References for Similar Systems
(Including Contacts You Can Call)
- ◆Project Manager's Resume'
- ◆Trainer's Resume'
- ◆Itemized Materials List

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MANUFACTURER QUALIFICATIONS

(Submitted With Bid Proposals)

◆Project List

◆Special Features

Require a project reference for each special feature required for the system. If manufacturer does not have reference but claims they can meet the special feature, add a \$250/day penalty clause tied to a specific date.

◆Normal Features

\$500/day penalty clause for claiming meeting specification requirements but actually fall short .

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TOOLS FOR THE OWNER

Issues Addressed Through The Specifications

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GENERAL

- ◆ Tie Contract To General Trades Requirements
Contract Procedures, Project Procedures,
Scheduling, Trades Coordination, Pay Request
Procedures
- ◆ Require Technology Contractor To Review and
Coordinate the Technology Raceways/Conduit
- ◆ Provide Two Years of Warranty With Bid
- ◆ Detail Training Requirements

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VOICE NETWORK

- ◆ Vendor Loads System Database Information
- ◆ Vendor Programs Initial Switch Operation
- ◆ Vendor Programs Initial Voice Mail Operation
- ◆ Train Local Building "System Administrators"
Who Implement Standard System Changes
- ◆ Have Vendor Fund "Dial Up Data Services"
Through Their Contract

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VIDEO NETWORK

- ◆ Vendor Loads System Database Information
- ◆ Vendor Programs Initial Operation
- ◆ Train Operator and Users On Actual Instructional Usage, Not System Operation
- ◆ Modem Access to System By Manufacturer
- ◆ Have Vendor Fund Contests For Best Instructional Program By Teacher & Students

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DATA NETWORK

- ◆ Vendor Loads System Database Information
- ◆ Vendor Provides CNE (Certified Network Engineer) For System Start Up
- ◆ Vendor Sets Up Computers / Printers
- ◆ Vendor Programs Initial Operation
- ◆ Modem Access to System By CNE
- ◆ CNE Is Provided As Part of Two Year Warranty

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UNIVERSAL SERVICE REPORT and ORDER (Universal Service Fund or E-Rate)

Meeks Technology Group clients are extremely interested and excited about the newly create technology funding mechanism available from the Federal Communication Commission (FCC). This report is being generated in an attempt to assist our clients understand the intent and status of the fund.

The US Congress created and passed the Telecommunications Act of 1996 that included Section 254, a tax on the local phone companies in the United States. Additionally, Section 254 stated that the FCC would generate a mechanism for distributing the revenue generated from that tax to eligible (eligibility defined by the FCC) schools and libraries. The FCC uses the phrase "Universal Service Report and Order" to describe the mechanism developed by the FCC to implement Section 254. The Order, adopted May 8, 1997, states schools and libraries would be eligible for \$2.25 billion per year in discounts towards the purchase of telecommunication services and internal connections for Internet and Distance Learning access. The fund that the revenue generated by the tax is placed into is called the Universal Service Fund. The discounted rate is known as the Education Rate (E-Rate). Funds are available for discounts starting January 1, 1998. (Unfortunately, the process of application is not in place at this time, therefore, MTG seriously questions the ability to receive, judge, and award applications by this date.)

NOTE - The local phone companies filed suit against the FCC earlier regarding the tax. The gist of the suit is that most state governments and their agency that determines policy for Public Utilities have already required the local phone carrier to offer discounted circuits rates to schools. Therefore, if the FCC requires the same local phone companies to also pay taxes which in turn are used to subsidize local school circuits costs, the local phone company would be double taxed. An out of court settlement was reached last Thursday, December 19, 1997, which reduced the tax on the local phone carriers by \$600 million. MTG is attempting to confirm this statement and whether the \$600 million relief is a one-time or annual item.

The FCC released an erratum correcting the Order on June 4, 1997, and released an Order on Reconsideration on July 10, 1997. MTG desires to emphasize the point that this Order is a *work-in progress* and is subject to more interpretation and clarifications. Additional Orders have been released that provide additional definition to the program. There is a temporary Fund Administrator, The National Exchange Carrier Association until a permanent one is appointed.

DISCOUNT RATE

Individual schools, school districts, libraries, and consortia comprised of those organizations are eligible. The E-Rate discount for eligible schools or districts is based in the Economic Disadvantage and Geographic Location of the school or district. The discount rate can be applied on either a district-wide or individual school basis.

The number of students eligible for the national school lunch program determines the Economic Disadvantage. This number can be determined by actual count or Title 1 alternate mechanisms.

The Office of Rural Health Policy of the Department of Health and Human Services has categorized areas as either rural (high cost) or urban (low cost). Rural areas are allowed a greater discount.

The actual Discount Schedule is as follows:

How Disadvantaged %of students eligible for national school lunch program	Discount Matrix	
	Urban %	Rural %
<1%	20%	25%
1-19%	40%	50%
20-34%	50%	60%
35-49%	60%	70%
50-74%	80%	80%
75-100%	90%	90%

SERVICES ELIGIBLE FOR E-Rate

Telecommunication Services

All voice or data telecommunication services commercially available to schools. Examples include:

- Ordinary telephone lines for calls to teachers in classrooms.
- Integrated Digital Services
- Satellite delivery for distance learning.
- Coaxial cable.
- Network lines to connect to information services.
- Private lines between eligible acquirers (your own WAN)
- Pagers for security and officials

Internet Access

Services required to access the Internet are available for discounts. This includes:

- E-mail and Basic access to World Wide Web
- Includes data links and additional associated services needed for classroom access to the Internet (i.e. 56K Leased line, ISDN, fractional or full T-1, frame relay, ATM, etc...) This essentially covers the WAN connecting all of a district's facilities.

Paid subscriptions to Internet Service Providers and voice mail are not eligible.

Internal Connections

Basic installation and maintenance of a network are eligible for discounts. The internal connections must be necessary to transport information (Internet or Distance Learning information) within the school to individual classrooms. Example of eligible items:

- Cabling system.

- Hubs and switches.
- Routers
- Network File Servers
- Software needed for operation of file servers.
- Wireless Local Area Networks

Personal computers used solely as switches or file servers are eligible for discount.

Bundled Services

Internet Access bundled as part of a combined procurement. Eligible content categories"

- Content otherwise available free of charge.
- Content separately available (but supported at a difference between the bundled price and the price for the content alone.)
- Minimal content (if not offered separately and affirmatively shown that it is a more cost effective means of securing basic conduit access, but only non-content portion supported.)

It is Meeks Technology Group recommendation that clients pursue discounts for one time type of expenditures. Success in applying for discounts through the USF do not automatically transfer from one year to the next. Therefore, annual fee services secured under the discount in 1998 may not be funded in 1999. However, we suggest that should a District determine that they wish to pursue discounts on annual fee services, the Board of Education should be involved in the process. The Board should be made aware of their exposure to funding changes in subsequent years that will require accommodation within future yearly district budgets.

ELIGIBLE CONTRACTS

When the conditions of the fund were first announced earlier this year, projects involving eligible services and slated for implementation in 1998 but already under contract, were not eligible. Due to the tardiness of establishing the USF approval process, this issue has become a moving target. The review board acknowledges that there are a number of projects that may already be contracted for that would have been eligible if the Fund approval process had been in place. It appears that projects already under contract but bid in the latter months of 1997 can apply for funds. Those applicants will need to submit all of the required documentation but will skip the 28-day bid period and submit Form 471 along with Form 470. The specifics regarding approval for these projects have not been defined.

APPLICATION PROCESS

The application process is directly tied to the operation of a FCC Web Site where all application forms will reside and all applicants are to submit their documents to. That Web site was originally scheduled to be on-line in October 1997. That date has been moved to mid November, then to mid December, and is now slated to be on-line January 12, 1998.

NOTE: Considering the information required for application that is outlined in the following sections, MTG has serious doubts of the Web Site capacity to handle this application process. Therefore, MTG is scheduling a trip to Washington DC in December with a number of MTG client

application packages. It is MTG's intent to gain approval from the Fund Administrator for MTG's specific methodologies and processes in order to streamline our clients Fund applications:

The following items must be submitted to the Fund Administrator.

1. *Certification* signed by the institution's procurement officer as to the level of discount based on economic need using the discount matrix.
2. *A Technology Plan* approved by an independent agency (such as State education or agency or other reviewer). Personnel related to the overall program have suggested that approval of the Technology Plan by the local Board of Education will suffice for this requirement. MTG has not been able to obtain a definitive statement on this issue. The Technology Plan must include:
 - A. Computer equipment currently available or budgeted for purchase.
 - B. Internal connections, if any, a school already has or anticipates installing.
 - C. Software for LAN and telecommunication connections currently available or budgeted.
 - D. Experience and training of staff in the use of the equipment.
 - E. Existing or budgeted maintenance contracts to maintain computers.
 - F. Capacity of the school's electrical system to handle simultaneous uses.

Additionally, schools must prepare a specific technology plan outlining the use of technologies, in the near term and future, and how the institution intends to integrate the use of technology with their curricula.

3. *A Description of Service* sought in sufficient detail so providers can bid on the services. We consider these to be the project specifications.
4. *The Amount of Funds* necessary to meet the financial obligations of the technology plans (including necessary hardware, software, and staff training) committed (budgeted and approved in time for use for this project) for the current funding year. The District must also certify that these funds are available.
5. *Additional Certifications*
 - A. That the institution is eligible to receive discounted services.
 - B. Those discounted services will not be resold and will be used only for educational purposes.
 - C. The applicant has and will continue to comply with all applicable State and local procurement processes.
 - D. Identification of all co-purchasers and allocations of services in aggregated purchases.

Due to the lateness of availability of the appropriate Web Site, the Fund Administrator and FCC has determined that for the first 75 days of application availability, all applications will be equally considered, not simply "first come-first serve." This is vitally important in that there are very large school systems (i.e. New York City Schools) standing by with very large applications that could pull most of the funding available into a few large districts.

6. *Application Form*

All of the information above must be accompanied with Form 470, the actual application form available in draft form on the E-Rate information site.

NOTE 1: We have reached the first major problem point, there is no definition as to how the approval process works. Documents available imply that if the Fund Administrator posts an applicant application on the Web Site, that represents approval of that application but no guarantee of funding.

POSTING for BIDS

The Fund Administrator will post the application, including the description of services sought to attract bids. The actual discounts will be calculated by the Fund Administrator and posted with the application. There will be a four-week waiting period after posting (28 days) before the applicant can enter into a contract with the service provider.

NOTE 2: Please note that the posting of an applicants request for services does not imply that the funding has been approved. Approval of amounts and actual encumbering of fund occurs after receipt of contract values. We would also like to state that we see the process of posting the request for services on the WEB as untenable. We believe that the E-Rate WEB site will only provide an abstract of the services requested. It would be impossible to post the specifications and project drawings to a WEB site due to the size of the storage requirements and interface problems for obtaining project drawings of the correct size. MTG does intend to post their client projects on the MTG file server, *meeksgEEKs.com*.

COMMITTEMENT OF FUNDS

Funding requests base on actual contract values will be submitted to the Fund Administrator on Form 471 (also available in draft form at the E-Rate WEB Site) by schools after the contracts are made, but the contract may be contingent on receiving funding. If sufficient funds remain, the Fund Administrator commits them and notifies the service acquirer (the contractor), that funding has been committed. The Fund Administrator also posts the commitments on weekly basis to their WEB server.

OVERVIEW OF APPLICATION PROCESS

Therefore, the sequence of application includes the submission of Form 470 and applicable documents, the advertisement for services on the WEB for 28 days, negotiation or determination of contract values, and the submission of Form 471. These four activities comprise the entire application process. Since then process includes contract value negotiation, it would typically also include approval of those same contracts by the Board of Education. (Note that approval of contracts by the Board of Education is not required in order to submit Form 471) Please keep these activities in mind when attempting to establish project time lines involving E-Rate funds.

NOTE 3: The original conditions of the USF stated that yearly funds would be allocated on a first-come first-served basis until \$2 billion in funds were encumbered. At that point, applications

from economically disadvantaged (most needy) locations would be processed until the money runs out. Based on comments from users, an FCC Order was issued in October requiring the Fund Administrator to treat all 1998 applications occurring in the first 75 days of application as if they came in all at the same time. With the first date available for posting service requests to the WEB server on January 12, 1998, MTG estimates the latest date an application can be initialized yet considered within the first 75-day window should be considered as February 25, 1998. That provides the applicant 28 days of bid request advertisement and five days to process Form 471.

AVAILABILITY OF E-RATE FUNDS

QED, a marketing information provider who concentrates on the education market, estimates the technology based expenditures for K-12 School Districts to range between \$4.5 and \$6 billion per year. This includes computers and software for those computers. MTG finds that the typical fund allocations of K-12 School District to have a very high percentage of funds spent on computers. Therefore, we estimate that the actual funds spent on cabling system, network hardware, routers, Wide Area Network products, phone systems, and telecommunication services to be \$1.5 to \$2 billion per year. Our points is that the funds available from the USF essentially double the revenue available for these services and are tied directly to actual funds being available to school districts or libraries. We find it unlikely that all of the USF will be encumbered within the first 75-day window. Therefore, we recommend that all of our clients with projects occurring after March 1, 1998 to continue to apply for E-Rate funds.

CERTIFIED CONTRACTORS

Only those contractors who are certified as "E-Rate" contractors can participate in receipt of E-Rate funds. To the best of our understanding, the certification process is to simply sign a document that states the contractor is willing to be paid through the "E-Rate" funds and is willing to wait for those payments.

PAYMENT PROCESS

Schools will process E-Rate eligible payment applications in a format (yet to be determined), that separates the schools funding obligation and the discount applied to the payment request. The school will process their portion of the payment and forward a copy to the Fund Administrator. The Fund Administrator will then process payment for the E-Rate contractor. At this time, there is no definition on the duration of a pay period (monthly or quarterly).

AUDITING

Schools will be required to maintain appropriate records necessary for future audits and to produce them upon request to any auditor appointed by the Fund Administrator or any other State of Federal agency with jurisdiction.

This document has been generated with the intent of notifying MTG clients of additional funding sources available for their use and a general understanding of how to access those funds. The information contained herein is accurate to the best of the knowledge of Meeks Technology Group (MTG) up to the time that this document was generated. In view of

the evolving nature of the USF/E-Rate application process, the information contained herein may be rendered obsolete or inaccurate based on future FCC Orders and interpretations by the Fund Administrator. Additionally, the information contained herein has been obtained from multiple sources. Though MTG is attempting to verify all interpretations and process descriptions, MTG takes no responsibility for the accuracy of those sources.



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